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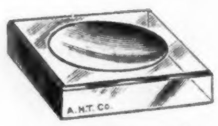

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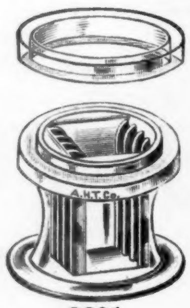

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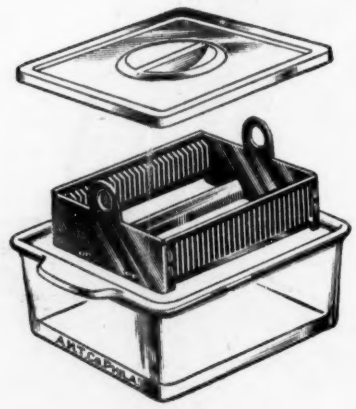

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INTERRUPTION OF CENTRAL ASIATIC EXPLORATION BY THE AMERICAN MUSEUM OF NATURAL HISTORY

By Dr. HENRY FAIRFIELD OSBORN
AMERICAN MUSEUM OF NATURAL HISTORY

IT will be a matter of very great regret to all members of the American Association for the Advancement of Science, and of the allied societies, to learn of the enforced interruption by the "Cultural Society" of Peking of the explorations by the American Museum of Natural History in Central Asia.

Scientists and educators of America have taken a very keen interest in the advancement of science in China, both indirectly by the establishment of educational institutions and directly by scientific surveys, such as those of Professor Bailey Willis. We have also opened all our educational institutions, both in pure and applied science, in all parts of the country, to students coming from China. We have extended to them other facilities and hospitalities, as well as financial aid, in many cases. In brief, it has been one of the dreams of our ever-hopeful and optimistic country to see China realize the full benefits of the "advancement of science."

It is one of the most regrettable incidents of recent times that the new Nationalistic spirit in China, in which we all rejoice, has been accompanied, and partly developed, by a spirit of anti-foreignism. This spirit is by no means confined to the political and economic sphere, but has also entered the intellectual and scientific sphere. The purely scientific and educational aims of other countries are misrepresented in the Chinese press, and popular opinion is inflamed against scientific exploration as hostile to the best interests of China. Striking examples of the working

of this anti-foreign spirit are seen in the new attitude towards scientific work and exploration in all parts of China. In order to illustrate what is going on and to correct certain misstatements which have appeared in the daily press, I have requested Dr. Roy Chapman Andrews, leader of the Central Asiatic Expeditions of the American Museum of Natural History, to submit a statement for the information of readers of SCIENCE regarding the interruption of the work of the Central Asiatic Expedition.

HEADQUARTERS OF THE CENTRAL ASIATIC EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY

PEKING, CHINA, JULY 22, 1929

Because of its bearing upon all foreign scientific exploration in China, it is desirable that the reasons for suspending exploration in Mongolia, during the year 1929, by the Central Asiatic Expedition of the American Museum of Natural History should be made known to the scientific world.

In 1926 the famous Swedish explorer, Dr. Sven Hedin, arrived in Peking and made preparations for a great scientific expedition to Inner Mongolia and Chinese Turkestan. Just before he was ready to depart in the spring of 1927 the "Society for the Preservation of Cultural Objects" started a newspaper campaign against Dr. Hedin. Although the main purpose of the Swedish expedition was meteorological investigations it included geologists, archeologists, zoologists and other scientists. The Cultural Society stated that Dr. Hedin intended to rob China of priceless treasures, infringe its "sovereign rights," and much more in the same vein. The Cultural Society, an entirely unofficial body, made its first appearance in a public way at that time; its activities had not previously come to the attention of foreign residents in Peking.

By an organized publicity campaign in the Chinese press it aroused such opposition to the Swedish expedition that the officials were intimidated and did not give permission for Dr. Hedin to depart until he had made arrangements with the Cultural Society. Negotiations dragged over many months. Finally Dr. Hedin felt that it was better to accede to the Cultural Society than to give up his entire expedition, which had been assembled in Peking at great expense and then was ready to go into the field. He was forced to accept a Chinese codirector, pay the salaries and expenses of ten Chinese students to accompany him on the expedition and agree to turn over all his collections to the Chinese. The Cultural Society agreed that they would give him back some of his material.

The peculiar circumstances which influenced Dr. Hedin in agreeing to such unfair conditions made future work most difficult for other foreign scientists. In the spring of 1928, when the Central Asiatic Expedition of the American Museum departed for the field, a war was in full progress not far from Peking. Marshall Chang Tso-lin, who represented the recognized government of China at that time, personally gave his permission to American Minister John Van Antwerp MacMurray for the expedition of 1928 to continue its explorations in Mongolia. Unfortunately, before the expedition returned to Peking in the autumn Chang Tso-lin was dead, his government had fallen and the Nationalists of Nanking were in control.

The Cultural Society, when our caravan arrived in Kalgan from Mongolia in August, 1928, carrying eighty-five boxes of fossils, telegraphed to the governor of the district ordering him to seize our collections. Meanwhile the society pursued its course of publishing articles in the Chinese press calculated to inflame public opinion, which had been so successful in the case of Dr. Hedin. We were charged with "stealing China's priceless treasures," "infringing her sovereign rights," "seeking for oil and minerals," "being spies against the government," etc., etc.

Although there is no law in China prohibiting or regulating in any way the collecting or exporting of fossils, this unofficial body, the Cultural Society, was able so to intimidate the officials that our collections were held at Kalgan for six weeks, namely, until late in September. Before the fossils would be released for preparation in Peking we were forced to sign an agreement with the Cultural Society stating, among other provisions, that in the future we must have their permission before carrying on further scientific work in China.

In January, 1929, Assistant Chief Walter Granger approached the Cultural Society in regard to the 1929 expedition which was intended to be the last of the series of seven. He was presented with the following demands which are herewith literally translated from the original Chinese by the Chinese secretary of the American Legation, Peking:

ARTICLE I

The Central Asiatic Expedition shall be commissioned by the Committee for the Custody of Ancient Objects to proceed to Mongolia to conduct explorations.

ARTICLE II

That the expedition shall consist of half each of Chinese and foreign members shall be taken as the fundamental principle in determining the number of members of the expedition. From each half of the members one shall be appointed as leader of the expedition.

ARTICLE III

All scientific materials collected, with the exception of the vertebrate fossils as provided for by Article IV, must be retained in China.

ARTICLE IV

(A) All duplicate specimens of vertebrate fossils obtained or those which are similar to previous finds shall be retained in China.

(B) As to those which differ from previous finds, but which for research must in fact be shipped to the United States, their shipment to the United States under the following conditions may be considered:

1. China shall send experts to collaborate whose traveling expenses for the round trip and all other expenses during the period of research shall be borne by the Museum of Natural History.

2. The American Museum of Natural History shall afford these experts with facilities for independent research.

3. After the completion of research, these articles in their original form must be shipped back to China. Those articles which must temporarily be retained in the United States for reference shall be clearly marked, when exhibited, "Deposited by the Society for the Preservation of Cultural Objects, Peking, China." In addition, two sets of casts shall be made exactly similar to the originals and sent to China.

These demands were so contrary to all precedent in China or any other country that at first we refused to accept them. However, we were willing to make unusual concessions in order to complete our eight years of work, by the 1929 field expedition. Eventually we agreed to all the demands except Article IV, A. It is obvious that until the fossils had been prepared and studied, under expert scientific direction, no one could say what was or what was not a "duplicate." We asked that the collection be allowed to go to the American Museum for this purpose, and after its preparation and study duplicates would be returned to China. The Cultural Society refused to agree to this proposal. They insisted that they had the final right to determine what fossils were to remain in China and what were to be sent to New York.

At this point negotiations were broken off in Peking but were continued in New York and Washington by President Henry Fairfield Osborn and Secretary of State Henry L. Stimson with the Chinese minister, Dr. Chao Chu Wu. Two months of continued negotiations ended in failure because, when an agreement with the Chinese minister was reached, the Cultural Society insisted upon the acceptance of its original demands, with only minor and unimportant modifications.

It had become obvious that the Cultural Society intended to hold, maintain and control the fossil collections of the expedition. In all our negotiations neither Mr. Granger nor I was able to discover any desire on the part of the Cultural Society to cooperate in a scientific spirit.

At the present time the Nanking government is discussing certain regulations governing the future collections of fossils in China. Press reports foreshadow the regulations. They state that one group wishes to keep all fossils in China, allowing only photographs to be taken out. The other, and moderate, group is willing to concede that duplicates may be taken away but the type and unique specimens must remain in China.

Laws already are in force prohibiting the shipping out of China of any bird skins at all, and of more than three specimens of mammals and reptiles of a single species for museums. But no laws are enforced prohibiting the killing and selling of birds by natives. In the market at Peking throughout the year thrushes and other song-birds are always on sale for food with ordinary game.

Such an attitude on the part of the Cultural Society and of the government of China means that all foreign scientific work in the country must cease. Museums can not send expensive expeditions if they are not allowed control of their collections. The Chinese themselves can not do the work, for they have neither adequately trained men nor the money to conduct investigations, and will not have for many years. Instead of opposing the progress of world science they should aid it, for they themselves have much to gain by cooperating in a true scientific spirit.

The American Museum of Natural History has already presented freely to China many prepared duplicate specimens of its Mongolian and other collections. It has repeatedly expressed its willingness to continue such gifts. It has given the Library of the Geological Survey of China scientific publications worth many thousands of dollars. President Osborn, when he visited Peking in 1923, discussed with the premier and cabinet officials plans for a great natural history museum in Peking and promised his enthusiastic support. The present paleontological section of the Museum of the Geological Survey, Peking, is almost entirely filled with exhibits which are Swedish or American gifts.

It is most regrettable that the spirit of cooperation which has actuated the Chinese under former governments should have suddenly changed with the present régime.

ROY CHAPMAN ANDREWS

To the above report should be added the statement that, through the active interest of the Chinese minister, Dr. Chao Chu Wu, a graduate of the University

of London, and Secretary of State Henry L. Stimson, the entire American Museum fossil collection of the year 1928 was finally released by the government of China and is now on its way to the American Museum, after a prolonged and most unfortunate delay since August, 1928, when the collection was first detained in Kalgan.

A description of this and the preceding collections in vertebrate paleontology will constitute Volume V of the publications of the Central Asiatic Expeditions. Dr. Andrews has remained in Peking to write Volume I, "Narrative of the Expeditions," which have now been in the field since 1921; Volume II, "Geology of Mongolia," by Professors Charles P. Berkey and Frederick K. Morris, is in circulation; Volume III, on the "Geology of Mongolia," by Professors Berkey and Morris, is now in press; Volume IV will be "Topography of Mongolia," which will include maps by L. B. Roberts, and the volume on "The Permian of Mongolia," by Dr. Amadeus W. Grabau, formerly of Columbia University and now of the Chinese Geological Survey, is in press and will soon be ready for the printer.

It does not appear an exaggeration to say that, as a result of our exploration and survey of Mongolia, the researches in geology, paleontology and zoology mark one of the most important scientific advances of the twentieth century. The publication of these scientific researches will be of great educational as well as economic importance to China. These discoveries have not only aroused interest throughout the entire scientific world, but have spread very widely and have renewed a healthy popular interest in China and Mongolia, to offset the always disturbing and conflicting political news which we receive from these countries.

The interruption of the work of the Central Asiatic Expeditions is a misfortune. The permanent suspension of this work from any cause would be a calamity in the advance of science.

AFRICA AND SCIENCE. II

By JAN H. HOFMEYR

PRESIDENT OF THE SOUTH AFRICAN ASSOCIATION

What then can Africa give to science? In reply to that I can do no more than suggest some of the lines along which Africa seems to be called upon to make a distinctive contribution to science.

First there are the related fields of astronomy and meteorology. To astronomy I shall but make a passing reference. This continent of Africa, more especially the highlands of its interior plateau, with its clear skies and its cloudless nights, offers wonderful facilities to the astronomer. As proof of the necessity of utilizing those facilities, especially with a view to the study of the southern heavens, I need but quote the words used by Professor Kapteyn on the occasion of the 1905 visit: "In all researches bearing on the construction of the universe of stars, the investigator is hindered by our ignorance of the southern heavens. Work is accumulating in the north, which is to a great extent useless, until similar work is done in the south." Africa has to its credit considerable achievements in the past in the field of astronomical research. The increased equipment now available should make it possible to increase greatly the amount of systematic work now being done, and to offer important contributions to astronomical science.

But probably of greater importance is the work waiting to be done in meteorology. Few branches of science have a more direct effect upon the welfare of mankind—that is a lesson which we in South Africa should have learned only too well—but in few has less progress been made. And in meteorological work Africa is probably the most backward of the continents. It is not so long since Dr. Simpson, of the London Meteorological Office, declared that, save from Egypt, his office received practically no meteorological information from the great continent of Africa. Moreover, the backwardness of meteorology is in large measure due to the intricacy of the problems involved, and the necessity of having world-wide information made available. The problems of meteorology are emphatically not the problems of one country or of one region. The South African meteorologist must see his problems *sub specie Africae* (the seasonal changes in South Africa depend on the northward and southward oscillations of the great atmospheric system overlying the continent as a whole); and quite apart from what he can learn from the rest of Africa, the Antarctic regions have much to teach him. But while the development of meteorological research throughout Africa is of supreme economic importance for Africa, Africa in its turn has its contributions to make to other continents. In particular, we should not forget the close interrelation of the meteorological problems of the lands of the southern hemisphere. The central position of Africa in relation to those lands gives not only special opportunities but also special responsibilities for meteorological observation and research. For the sake both of South Africa and of science in general I

would venture to express the hope that this second visit of the British Association will give as powerful a stimulus to meteorology as did the first to astronomy.

Next, I would refer to Africa's potential contributions to geological science. Africa is a continent, portions of which have always had a special interest for the geologist because of the great diversity of the geological phenomena manifested, and the vast mineral wealth which, as its ancient workings so abundantly prove, has attracted man's industry from the very earliest times. But in our day the opportunities which it offers to the geologist to make contributions to the wider problems of science are coming to be more fully realized than ever before. Of special interest in this connection is the light which African geology, more especially in the form of the study of ancient glacial deposits, can throw on the Wegener hypothesis of continental drift. In the past our geologists have thought mainly of the correlation of our formations with those of Europe. It is time that they paid more attention to their possible affiliations with those of the continents to east and west of us. If geology can establish the hypothesis that Africa is the mother continent from which India, Madagascar and Australia on the one side and South America on the other have been dislodged, it will give a new orientation to many branches of scientific activity. For that investigation also Africa occupies a central and determinative position in relation to the other continents, such as we have noted to be the case in the sphere of meteorology. There are many other geological problems on which Africa can probably shed much light. There is, for instance, the constitution of the earth's deeper sub-strata, in regard to which, as Dr. Wagner has recently pointed out, the study of the volcanic Kimberlite pipes, so numerous throughout Africa south of the equator, and of the xenoliths they contain, including the determination of their radium and thorium contents, may be of the greatest significance. There is the possibility that the exploitation of Africa's great wealth in potentially fossil-bearing rocks of presumably pre-Cambrian age will yet yield us remains of living beings more primitive than any yet discovered; there are the great opportunities of study which the African deserts offer in the field of desert geology and morphology, and there is the assistance which African geology has rendered to vertebrate and plant paleontology, and can render to African anthropology in the investigation of this great museum of human remains and relics which we call the continent of Africa.

I pass on to medical science. I have referred already to the contributions to the study of the problems of industrial medicine and hygiene which the special circumstances of the South African gold-mining industry have made possible. Those contributions have, we may well hope, but prepared the way for advances of a revolutionary character in the early detection, prevention and treatment of all forms of respiratory disease. But even greater are the opportunities which the continent of Africa offers for the study of tropical diseases, of which it may well be described as the homeland. In Africa there have been and necessarily must be studied the problems connected with malaria, blackwater fever, sleeping sickness, yellow fever and many other scourges of civilization, and from Africa there may well come hope and healing for mankind. There are other problems of medical science for the study of which Africa is uniquely fitted. There are the physiological questions, important also from the political point of view, which bear on the fitness of the white races to maintain a healthy existence in tropical surroundings, at high altitudes and in excessive sunlight. For these investigations the diversity of conditions prevailing in the various regions of the African continent make it a magnificent natural laboratory. There is the elucidation of the factors which account for the varying susceptibility of white and colored races to acute infectious diseases, tuberculosis and certain types of malignant disease, together with the light which such elucidation may throw on the physical and chemical composition of the human body. Lastly, I would mention the exploration of that most interesting borderland between psychiatry and psychological science by an analysis of the mentality of the diverse African peoples. That investigation has an important bearing not only on the limitations and capacities of racial intelligence, but also on the methods which the ruling races in Africa should follow in seeking to discharge their obligations towards their uncivilized and unenlightened fellow-Africans.

Closely linked with medical science is the study of animal biology. In some instances the problems of the two branches of science are to be approached along parallel lines; in others, biological investigations are fundamental to the growth of medical science; of no less significance is that unity which there is in nature, making it possible for the truths of animal biology to be translated into facts concerning mankind. In the African continent there is no lack of opportunity to advance science by physiological inquiries into animal structure, by the isolation of the parasites of human and animal diseases and by the tracing of the life histories more especially of the minuter forms of animal life. "Nowadays," in the words of Professor J. A. Thomson, "the serpent that bites man's heel is in nine cases out of ten microscopic." But scarcely less important are the exten-

sive facilities which Africa still offers for the study of the habits and behavior of the larger mammals. The naturalistic study of these animals, not as stuffed museum species, but in the laboratories of their native environment, has received all too scanty attention from the scientist, and this is a reproach which African science, with its rich dowry of mammal and primate material, may confidently be expected to remove. Nor will this study of animal behavior, especially of those animals which approach nearest to the human type, be without its bearings on our investigations of the workings of the human mind. If in this hasty survey I may take time to mention one more point within this field, I would refer to the results which await the intensified activity of the marine biologist and the oceanographer in the as yet all but virgin territory of the African coast-line. This association of ours has long dreamed of an African marine biological station as broad in its conception and comparably as useful from the wider scientific and the more narrowly economic points of view as those of Plymouth or Naples or Woods Hole, and withal a rallying point for the naturalist, the zoologist, the botanist, the geographer, the anatomist, the physiologist—indeed for all those workers whose diverse problems meet at the margin of the sea.

From animal biology we pass by an easy transition to anthropology, the study of man himself. And here Africa seems full of splendid promise of discovery that may verify Darwin's belief in the probability that somewhere in this land-mass was the scene of nature's greatest creative effort. It would seem to be not without significance that Africa possesses in the chimpanzee and the gorilla those primate types which approach most nearly the form and structure of primitive man. To that must be added that in the Bushman, Pygmy and negroid races Africa has at least two and possibly three early human stocks which are characteristically her own and belong to no other continent. No less striking is the fact that in Gibraltar, in Malta and in Palestine, that is, at each and every one of the three portals into Africa from Europe and Asia in Pleistocene times, there have been discovered evidences of the presence of Neanderthal man. In Africa itself there was found at Broken Hill some nine years ago a skull with the most primitive or bestial facial form yet seen, and so closely akin to the Neanderthal stock as to establish firmly the expectation of finding further compelling evidence of a long-continued Neanderthaloid occupation of the African continent. The discovery at Taungs, on the one hand, which reaches out towards the unknown past, and the finds at Boskop and in the Tsitsikama, on the other, which assist in linking up the period of Rhodesian man with the coming of the Bushfolk, open up to us, in conjunction with the aforementioned facts, a vista of anthropological continuity in Africa such as no other continent can offer. The recent investigations in the Great Rift Valley, near Elementeita in Kenya, and the fossil discoveries on the Springbok Flats, north of Pretoria, have again fixed the attention of the anthropologist on Africa.

Nor are the data presently available restricted to these discoveries. The efforts of archeologists and the application of improved scientific methods in excavation are giving us stratigraphical evidence of the succession of stone cultures which is of the utmost importance. I have already mentioned the assistance which geology can render in this work, but there is needed also the cooperation of those who labor in the converging fields of anatomy, archeology, paleontology and comparative zoology. That cooperation has already commenced. In the investigation of the Vaal River gravels it has yielded important results, and we may look forward to its continuance and expansion in the years that lie ahead. Of the importance of African anthropology for the understanding of that of Europe there can be no question. Work of importance has already been done in the study of the relations between Paleolithic art in Europe and Paleolithic art in Africa. The significance of these comparisons is but emblematic of the importance of similar investigations in regard to stone cultures, rock engravings, ancient mining, stone circles and ancient ruins, methods of primitive mining and agriculture, tribal organization, laws and customs—indeed the whole range of the hitherto unexplained or partially explained phenomena of living and extinct cultures. There is no lack of avenues which the student of African anthropology may follow in the hope of finding at the end of them results of supreme value for science in general.

I would speak next of the vast field, as yet almost uncharted, of phonological and philological study. Here in Africa we have great opportunities for the examination of linguistic problems, and some of them have bearings which extend far beyond the limits of Africa. One thinks first of the opportunities which Africa offers for investigating the results of the transplantation of languages, which have a long history of cultural development behind them, to regions inhabited by primitive peoples. Here there are two sets of phenomena, each with its own special interest. On the one hand we have the modification of the languages of those European peoples who have established themselves in Africa as permanent settled communities, under pressure of the new linguistic influences into contact with which they have been brought. Of these phenomena the study of Afrikaans offers perhaps the best examples to be found in the

whole field of linguistics—its importance for the student of comparative philology is very far from being adequately appreciated. On the other hand we have those cases where European languages have come to Africa as the languages not of settled communities, but of officials and others like them who are but temporarily domiciled in this continent, and leave no descendants behind them to carry on the process of evolution of distinctive forms of speech. Here the phenomena which are of interest to the student of linguistics are to be found in the wealth of deformation and adaptation which the native populations have introduced in their endeavors to speak the European languages of their rulers. Work such as has been done by Schuchardt in Negro-Portuguese and Negro-French opens up a wide area of most attractive investigation.

But the most important task in the field of African linguistics is the actual recording of the native languages of Africa, our backwardness in respect of which is a reproach to science. Such study is, of course, important in relation to Africa itself, but of even greater significance for my present purpose is its bearing on scientific problems of wider scope. In that connection I would suggest two points. We are still only at the beginning of the study of Comparative Bantu. That in due course should lead to a knowledge of Ur-Bantu. Such a study and such a knowledge will necessarily be of importance to the comparative philologist, both because of the light shed by the study of one group of languages on the study of other groups, and also because it opens the way to the investigation of the relationship of Bantu to the other African tongues, and its place in the general scheme of the languages of the world. But of even greater interest is the study of African languages as throwing light on the inter-penetrations and interactions of primitive peoples. Language is a function of social relationship, and its study is therefore of great value for ethnological and historical investigations. May I give one instance of what I have in mind? Two millennia back southwest Arabia was the seat of the powerful commercial civilizations of the Mineans, the Sabeans and the Himyarites, radiating eastwards to India and southwestwards to Africa. The extent of their relationship with Africa it has hitherto been most difficult to trace, but linguistic evidence may prove to be of great value. Professor Maingard has pointed out to me that the Makaranga who live near Zimbabwe call water "Bahri," a word closely related in form to "Bahr," the "sea" of the Arabs, although the Makaranga themselves are not a sea-board people, and that "Shava" is their word for "to sell or barter," while to the Himyarites "Saba" meant to travel for a commercial purpose." Not less suggestive is the study of place-names, and while I do not suggest that I have evidence on which any conclusion can be based, I do contend that these investigations may prove to be of a most fruitful character. It would be interesting indeed to see what evidence linguistics can bring in respect of the relationship of South Africa with Madagascar, and also with Polynesia through Madagascar, where the tribe once dominant politically, the copper-colored Hova, are ethnologically and linguistically Melanesians amid the darker-hued Sakalavas and other negroid tribes. It may even be that such studies will conjure up to our minds pictures of great migratory movements with Arab dhows and South Sea praos cleaving the waters of the Indian Ocean. Only last year a canoe constructed of wood native to southeastern Asia was found in Algoa Bay.

And, finally, in this survey of what Africa can give to science, I would refer, with the utmost brevity perforce, to Africa as a field favored as is no other for the study of all those complicated problems which arise from the contact of races of different colors and at diverse stages of civilization. Of those problems, ranging from the investigations of the biological factors involved in the conception of race to the practical problems of the administration of backward peoples I need not speak. They have come to be part almost of the every-day thinking of most civilized men. What I would emphasize is that in Africa, as nowhere else, the factors which constitute these problems can be studied both in isolation and in varying degrees of complexity of interrelationship, that in Africa we have a great laboratory in which to-day there are going on before our eyes experiments which put to the test diverse social and political theories as to the relations between white and colored races, that in Africa there are racial problems which demand solution, and the solution of which will affect or determine the handling of similar problems throughout the world. We hear men speak of the clash of color, and are sometimes told that Africa is the strategic point in that struggle. I think of it rather as the continent which offers the richest opportunities to those who would investigate racial problems in the true spirit of science, and so discover the solutions which may yet enable that clash to be averted and the threat which it implies to our civilization to be dispelled.

I have sought—briefly and all too inadequately—to indicate some of the lines along which Africa seems to be able to make a distinctive contribution to science. It remains for me, yet more briefly, to speak of Africa's challenge to science, and to seek to answer the question, What can science give to Africa? I shall not stop to emphasize the point that the greatness of Africa's potential contributions to science, the key which perhaps she holds to the riddle of human

origins, the intriguing vistas opened up in the study of her relationship with South America and Australasia with its suggestion of past continental continuity, that all these and more constitute a challenge to science to actualize those potentialities. Let me seek rather to define the twofold challenge of Africa in another way. Firstly, Africa defies science to unravel her past. Throughout history she has ever been the continent of mystery. She was so to that pioneer of geographers, Herodotus, to whom nothing that was told him about Africa was so improbable that he declined to give it credence. She was so to the Romans, who regarded Africa as the natural home and source of what was strange and novel and unaccustomed. She was so to the navigators who did so much to break down the barrier wall between the Middle Ages and the Modern World. And though in our day the geographical mysteries of Africa have in large measure been solved, the work of the prober of her scientific secrets is only beginning. Then, secondly, Africa challenges science to define, to determine and to guide her future. If the great resources of this vast, undeveloped continent are to be made available for humanity in our own and the succeeding generations, science must make it possible for the man of European race to undertake that work of development by showing him how to protect himself, his stock and his crops against disease, by enabling him to conserve and utilize to the greatest extent the soils, the vegetation and the water supplies of the continent, by bringing to bear the resources of modern engineering on the exploitation of its wealth and not least by determining the lines along which white and colored races can best live together in harmony and to their common advantage.

That is the challenge of Africa to civilization and to science. It is not now thrown out for the first time; it is not the first time that it will have been taken up. It is in Africa that the Greco-Roman civilization won some of its most glorious triumphs, in Africa that the spade of the archeologist has in our day, by uncovering great Roman towns with noble public buildings and efficient irrigation systems, provided impressive evidence of the magnitude of the achievement of Roman imperialism. But Rome failed to conquer Africa for civilization, and left the challenge to those who were to follow after. She failed chiefly for two reasons: the might of African barbarism and the defiant resistance of African nature. We in our day, confronted by the same challenge, still have the same enemies, hitherto victorious, to contend against. But we meet them with the advantage of having resources at our disposal which our Roman predecessors lacked. It is to use those resources effectively that Africa challenges science.

In dealing with African barbarism we have weapons such as Rome could never dream of, and not the least valuable are those provided by the scientific investigation of the native peoples of Africa. The way to the solution of the problems presented by African barbarism is to be sought in an understanding of the character and mentality of primitive peoples, in the exploration of those regions in their social life where are to be found the factors that determine their reaction to diverse methods of administration. The study of African languages and of African anthropology is therefore fundamental to the development of the continent. For that work Africa possesses special advantages, and one can but hope that the facilities now being built up in our South African universities will be recognized in Britain and elsewhere, and become an important factor in the response of science to the challenge of Africa.

Not less formidable is the conquest of African nature, for the achievement of which also we in our day are far better placed than were the Romans. It is modern science which gives us that advantage. Three great tasks confront science in the conquest of African nature. First, science must make Africa safe for the white man to live in. I have spoken of the opportunities which Africa offers for the study of tropical diseases as likely to yield results of significance for science in general. But primarily will those results be of significance for the development of Africa? This part of the challenge of Africa is not lightly to be taken up. Africa has taken heavy toll of science. The recent deaths in Nigeria of Stokes, Young and Noguchi, worthy followers in the tradition of Lazear and Myers, are a reaffirmation of the gravity and insistence of that challenge. The importance for the cause of civilization of a successful response to that challenge can not be illustrated better than by the story of the construction of the Panama Canal. De Lesseps attempted the task and failed. For every cubic yard of earth excavated by him a human life was sacrificed to yellow fever or malaria. It was the successful attack some twenty years later on the death-dealing mosquito under the direction of General Gorgas that made possible the completion of one of the most important engineering enterprises of modern times.

Secondly, science must combat the foes which have to be contended with in the development of African agriculture. Africa is prodigal indeed in the production of insect and other foes to cattle and to crops. Science is already making an effective response to this part of the challenge. But there is much that remains to be done. And we shall be none the worse for the timely realization by the politician and the administrator of the contributions which science can make.

All too often in the past settlement schemes have been undertaken and ended in disaster in areas unhealthy to man, beast or crops, when, if the scientist had first been called in, precautions might have been taken which would have averted the calamity.

Finally, science must harness the great resources of Africa. And here there are suggested to us all the varied contributions which the engineer can make in the work of development. Has not the Institution of Civil Engineers defined the ideal underlying all engineering activity as "the art of directing the great sources of power in nature for the use and convenience of man"? Africa offers abundance of opportunities for the realization of that ideal. It is not by working in isolation that the engineer will realize it, but rather by cooperation with his colleagues in other branches of science, and by the correlation and coordination of the essential data which they must do so much to provide. First in the order of engineering development come the civil and mining engineers. Their tasks are the provision of facilities for communication, for health, for the conservation of agricultural assets, for the production of raw material and for the development of mineral resources. In their train there follow, with the advent of industrial activity, the mechanical and electrical engineers. Their tasks are to make the fullest use of the revolution in ideas of transport, including transport by air, which have resulted from the perfecting of the internal combustion engine, and to secure the maximum advantage possible from cheap production and efficient distribution of electrical power. The day must come, to give a concrete instance, when the Victoria Falls, with their immense water resources, will mean much more for Africa than Niagara to-day means for America. Later still there will be called in the services of the chemical engineer, ever engaged in problems of research to ascertain the most advantageous processes of converting raw materials into manufactured articles. In all these tasks it is the South African engineer who has, under the conditions of an undeveloped land, built up a technique and practice suitable to African requirements and showing promise of wider applicability, that we may well expect to assume a position of leadership and of inspiration. These are some of the ways in which science can respond to the challenge of Africa.

The picture which I set out to portray I have now completed. I have tried to suggest something of the magnitude of the rewards which Africa has in store for the scientist who has the enterprise to adventure and the vision to see. I have sought also to be the medium of the challenge presented to science by Africa's opportunities and needs. It is a vast canvas on which I have had to work. On it I have drawn but a few sketchy outlines. Yet I hope that the vision stands out clear. I hope that I have said enough to convey the power of its inspiration. Not least do I hope that you, our visitors, will play a great part, in the time that you will spend with us, in filling in some of the details of the picture, and in quickening and vitalizing its message for the scientists of South Africa. It is to them chiefly that it makes its appeal. The development of science in Africa, of Africa by science, that is the promised land that beckons them. I believe that they will not be disobedient to the vision.

OBITUARY

JOHN MERLE COULTER[1]

DR. JOHN MERLE COULTER was born at Ningpo, China, November 20, 1851. His parents were missionaries sent by the Presbyterian church to work in China, the family being left fatherless through death in 1853. John M. Coulter and his brother, Stanley, in the care of their mother, returned to southern Indiana, where their boyhood days were spent. His college education was secured at Hanover College, from which he was graduated with the A.B. degree in 1870 and from which he received his master's degree in 1873. The degree of doctor of philosophy was conferred on Dr. Coulter by the University of Indiana in 1882, and the degree of doctor of laws was conferred by the same institution in 1920.

After a period of secondary-school teaching at Logansport, Indiana, Dr. Coulter became professor of natural sciences at Hanover College, where he taught from 1874 to 1879. He then went to Wabash College, where he was professor of biology from 1879 to 1891. Then he continued his particular interest in botany as professor of botany in the University of Indiana, where he was also president from 1891 to 1893. He was president of Lake Forest University from 1893 to 1896. With the establishment of the department of botany of the University of Chicago, Dr. Coulter became a part-time teacher in that department and he soon resigned the presidency of Lake Forest University, becoming head of the department of botany of the University of Chicago, where he remained from 1896 to 1925. When William Boyce Thompson became interested in establishing an institution for plant research he consulted Dr. Coulter, amongst others, and finally asked him to become adviser in the organization of the Boyce

[1] At the fifth New York meeting of the American Association for the Advancement of Science the council named a special committee to prepare a statement for the association in memory of the late Professor John M. Coulter. The committee's statement is presented herewith.

Thompson Institute for Plant Research. Dr. Coulter responded favorably and he continued in that capacity until his death in Yonkers, New York, on December 23, 1928.

Probably the most important single stimulus to Dr. Coulter's earlier botanical work came as the result of his membership in the Hayden Survey of the Western Territories in 1872. He was made a member of that survey as assistant geologist, but it soon became evident that his interest in plant life was of even greater importance than his interest in geology. Soon after the beginning of the work he was appointed official botanist in the Hayden Survey Expedition. In a talk to graduate students Dr. Coulter once explained how he came to be appointed as botanist. He said that after most of the day's work was done and while some of the other members of the party were sitting around the camp engaged in activities which did not particularly interest him, he went "plant scouting and collecting" and soon had acquired a large collection of plants which were then new to botanical records. During the preparation of his report of the Hayden Expedition, he consulted Professor Asa Gray, with whom he later continued his botanical studies. During his life he often referred to the very great influence Asa Gray had on his work, and undoubtedly that relationship was an important factor in the systematic work to which Dr. Coulter's earlier efforts were directed.

While teaching at Hanover College in 1875, Dr. Coulter started the publication of a small pamphlet which was the beginning of the *Botanical Gazette*. There was not a large demand for this publication at that time but the publication itself helped to create the demand which made possible the present magazine, which is known wherever students are interested in botanical science. The earlier years of the magazine, like Dr. Coulter's own interests, were primarily taxonomic. Then, toward the close of the nineteenth century, when morphology began to be more fundamentally organized, the *Gazette* changed accordingly and helped to develop the change in attitude. In a similar way physiology and ecology, as emphasis has changed, have found their place in the changing attitude of the magazine. The progressive spirit of Dr. Coulter and the other editors with whom he associated himself is well illustrated in the comprehensive and inclusive representation of botanical science in its own changing periods. The publication of the *Gazette* was always at great sacrifice of time and effort on the part of Dr. Coulter and in its early years it often included financial sacrifice as well.

Some of Dr. Coulter's most important publications are mentioned below:

1885	"Manual of the Botany of the Rocky Mountain Region."
1893	"Manual of Texan Botany."
1894–1896	"Preliminary Revision of North American Species of Echinocactus, Cereus and Opuntia."
1900	"Monograph of North American Umbelliferae."
1901	"Plant Relations," an elementary text-book.
1903	"Morphology of Angiosperms."
1904	"Plant Structures," an elementary text-book.
1904	"Plant Studies," an elementary text-book.
1906	"A Text-book of Botany," an elementary text-book.
1909	"New Manual of Botany of the Central Rocky Mountains."
1910	"Morphology of Gymnosperms," in collaboration with others.
1910	"Text-book of Botany," a general college text-book, in collaboration with others.
1914	"Fundamentals of Plant Breeding," in collaboration with others.
1914	"The Evolution of Sex in Plants," in collaboration with others.
1916	"Evolution, Heredity and Eugenics," in collaboration with others.
1918	"Plant Genetics," in collaboration with others.

Dr. Coulter became a member of the American Association for the Advancement of Science in 1883 and was elected a fellow in 1884. He served as general secretary of the association for the annual meeting held in Denver, in August, 1901, in place of Dr. William Hallock, who had been elected general secretary but was not able to be present. Dr. Coulter was elected president of the American Association in 1918 and presided at the third Baltimore meeting, in December of that year. He gave his retiring presidential address, on "The Evolution of Botanical Research," at the third St. Louis meeting in December, 1919. He served on many important special committees of the association during his long and useful period of membership. His membership and guiding influence have also been appreciated in many other organizations of national scope, notably the Botanical Society of America, the American Association of University Professors, the National Academy of Science, and religious organizations such as the Presbyterian church, in which he was an active member throughout his life.

Notwithstanding the scientific achievements and guiding judgment in national affairs which were so conspicuous in Dr. Coulter's life, it is probable that his greatest influence was through his teaching of general students and in his guidance of his special research students in botany. His lecture room was

always an engaging place for the listener. Many students enrolled for whatever course Dr. Coulter presented and did so in many cases more because Dr. Coulter gave the course than because of the subject. His readiness in use of his extensive and accurate vocabulary and fine phrases enabled him to make difficult matters clear even to those who did not have adequate personal experience on which to base interpretations. To him it was a matter of the greatest importance that speech should be appropriately organized to convey ideas. Vague and "wobbly" statements were not common with him, but clean-cut and picturesque elucidation appeared whenever he spoke. This characteristic gave him one of his most important powers to assist the many graduate students who worked in the department of which he was the guiding spirit. Many articles published by his students are far better than they could have been without his help, and many are in print which could scarcely have appeared without his criticism.

At a testimonial of appreciation a volume was presented to Dr. Coulter on the occasion of his seventieth birthday by those who had received their doctor's degrees under his supervision. The volume consisted of the bibliographies of publications by these students.

More than two hundred of Dr. Coulter's students have contributed to the endowment of the John M. Coulter research fellowship which was established before Dr. Coulter's death and is administered by the department of botany of the University of Chicago. In addition to this testimonial and through the efforts of a committee organized by admiring friends who were not Dr. Coulter's students, testimonials of appreciation had been provided and were to have been presented to Dr. Coulter at the last New York meeting of the American Association. Though he had been advised of this forthcoming additional expression of admiration and affection from his colleagues, his death, on December 23, 1928, made it necessary for the testimonials to be presented to other members of his family.

Statements regarding the life and work of Dr. John M. Coulter appear in SCIENCE for February 15, 1929, in the *Botanical Gazette* for March, 1929, and in the *University of Chicago Magazine* for March, 1929.

OTIS W. CALDWELL
HENRY C. COWLES
WILLIAM CROCKER
L. R. JONES
R. A. HARPER

RECENT DEATHS

DR. CHARLES WILLIAMSON RICHARDSON, professor emeritus of laryngology and otology of George Washington University, and a member of the board of trustees of the American Medical Association, died on August 25 at the age of sixty-eight years.

PROFESSOR W. H. PERKIN, research chemist, Waynflete professor of chemistry at the University of Oxford since 1912, and fellow of Magdalen College, died on September 17 at the age of fifty-nine years. Before going to Oxford Professor Perkin had been for twenty years professor of chemistry at Victoria University, Manchester.

THE death is announced of Dr. Wilhelm Brandt, professor of botany and pharmacognosy at the University of Frankfort.

SCIENTIFIC EVENTS

RECENT ADDITIONS TO THE SOUTH KENSINGTON MUSEUM

ACCORDING to the London *Times* a large number of important objects have been added, during the past six months, to the collections of the Science Museum, South Kensington. In the entrance hall there was until recently a copy of the locomotive Rocket of 1829, constructed for Mr. Henry Ford by Messrs. R. Stephenson and Co., for his museum at Detroit. This has now been withdrawn for shipment to America. At the foot of the main staircase the rotation of the earth will shortly be demonstrated by a pendulum, suspended from the roof of the museum, as in Foucault's experiment. In the collection illustrating radio-telegraphy accurate copies of the original apparatus used by Hertz, including the oscillators, resonators, prisms and reflectors with which he demonstrated the essential optical properties of electromagnetic waves, are now exhibited. Together with the original apparatus of Sir Oliver Lodge, Signor Marconi and Sir Ambrose Fleming, these copies of Hertz's apparatus form a part of a collection designed to illustrate the growth of radio communication from its earliest beginnings up to the present day.

On the first floor in the collection of early sailing ships a model of an Elizabethan galleon is on exhibition. This has been constructed in the museum from data which were collected by Samuel Pepys and which are now preserved in the Pepysian Library at Magdalene College, Cambridge. The mast and rigging will be added in the autumn. On this floor in the old buildings glass technology is now much more adequately represented; models of glass furnaces of the twelfth and sixteenth centuries, specimens showing stages in manufacture of optical glass, and many other products of the industry are represented. Ad-

ditions of early British ploughs have been made to the collection of agricultural instruments.

On the second floor an Egyptian astronomical instrument dating from about 600 B. C. for determining the hours of the night has been added to the time measurement collection. In the astronomical gallery on the third floor a series of illuminated transparencies is being arranged to show selected photographs of the sun and moon, nebulae, star clusters, comets and of solar eclipses. The collection illustrating photography has been arranged in a gallery on the same floor, where a series illustrates the development of photography from the earliest years down to the present day. A group of objects shows the evolution of the home cinematograph.

THE NEW YORK SKIN AND CANCER HOSPITAL

While announcing the decision of the Board of the New York Skin and Cancer Hospital to sponsor a public appeal for $5,000,000, with which to improve and enlarge the institution, Dr. Ancell H. Ball, president of the hospital, reports the purchase of the grounds and buildings of its neighbor, the Lying-In Hospital, at Seventeenth Street and Stuyvesant Park, as a part of a program of expansion and increased facilities.

The purchase was made possible by the decision of the Lying-In Hospital to merge with the New York Hospital and remove to the medical center to be established on the upper East River. The institution resulting from the merger is the New York Hospital-Cornell Medical College Association. The changes announced are scheduled to be made sometime in 1931.

Mr. Ball made public the following statement:

> For a number of years the New York Skin and Cancer Hospital, the oldest institution of its kind in the country, and the second oldest of its kind in the world, has been seriously hampered in every department of its work, particularly by lack of clinical space for its steadily increasing volume of service to the poor and by inadequate laboratory facilities for its activities in cancer research. In 1928 alone, 150,000 treatments were given in our Out-Patient Cancer and Skin Clinics, or 44 per cent. of the total number of visits to the nine largest skin clinics in greater New York.
>
> During the last twenty years the hospital has been obliged to annex eight brick dwellings and two store properties to serve as auxiliary buildings. The majority of these are linked by a series of dark and tortuous passages which create a serious fire hazard. The general physical plan of the institution, as it is constituted at present, confronts us with every conceivable kind of problem with regard to lighting, ventilation and sanitation.
>
> Our staff has labored valiantly, both in the clinical and the laboratory departments, but there is a limit to what can be accomplished in the face of such physical handicaps. The institution, which has more than demonstrated its effectiveness as a front line unit of attack in the warfare of science upon humanity's greatest scourge, deserves and must be given the very best of accommodations and facilities.
>
> A considerable sum will have to be spent for improvements and additional new equipment. However, when the necessary renovating work is done, our bed capacity will have increased from 92 to 300, we shall have one operating amphitheater and four operating rooms of modern design as against the single operating suite now in use, and there will be sufficient space and excellent ventilation and lighting under one roof for the clinics and research laboratories which are now so inconveniently and unscientifically distributed throughout the neighborhood.

The needs of the hospital to be presented to the public are as follows:

Purchase and remodeling of Lying-In Hospital property		$1,750,000
Furnishings and new equipment		500,000
Radium and Emanation Plant		290,000
Research		1,000,000
Charity Endowment		1,200,000
Maintenance:		
1929	$ 60,000	
1930	100,000	
1931	100,000	
		260,000
Campaign objective		$5,000,000

THE POPULARIZATION OF CHEMISTRY

An endowed program, utilizing the women's clubs throughout the country to educate the public to an understanding of chemistry and its function in national defense, was officially adopted on September 12 by the division of chemical education at the semi-annual meeting of the American Chemical Society meeting in Minneapolis.

The final session considered a non-technical syllabus of study courses for the women's clubs, expressly designed "to make chemistry understood by those outside it and to give that newness of vision and awakening of interest which come from a knowledge of what chemistry is doing and may do for us."

The program of popular study courses, officially adopted, opens with the romance of chemistry; points out the impossibility of naming any three things of importance with which chemistry is not involved; explains that the human body is a chemical factory, what makes some water hard and other water soft, how soap is made, the use of nitrogen and potash for fertilizer and the importance of sufficient sources of supply and compares the chemical elements in cotton with those in silk.

The concluding sections of the course deal with such titles as: "Why do large manufacturers of explosives produce so wide a variety of peace products?" "Have explosives been a blessing or a curse to man?" "Classes of explosives and uses and values of each in war and peace" and "Which is the real goal, 'peace regardless of security' or 'lasting peace in permanent security'?"

According to the announcement of the American Chemical Society, the effort is endowed by the Chemical Foundation, headed by Mr. Francis P. Garvan, under provisions requiring the disbursement of any profits for the advancement of chemistry as a science and an industry in the United States. In addition, the foundation is also undertaking to administer any chemical patents resulting from researches in any American university under the same provisions.

The program was reported to the Division of Chemical Education by Dr. Harrison Hale, of the University of Arkansas, and after it was officially authorized Professor John N. Swan, of the University of Mississippi, and M. B. McGill, of the Lakewood (Ohio) High School, were elected by the division to supervise other educational activities.

PUBLIC EDUCATION AT BROOKLYN BOTANIC GARDEN

THE July issue of the *Brooklyn Botanic Garden Record* (Vol. XVIII, No. 4, pp. 189–264) is devoted entirely to a report on "Public Education at the Brooklyn Botanic Garden, 1910–1928." A report on "Research at the Brooklyn Botanic Garden, 1910–1927," was issued in July, 1927. The present report on the educational work reveals the practically unlimited opportunities for botanic gardens in the latter field; and in its development along this line the Brooklyn Botanic Garden is said to be unique among the botanic gardens of the world.

The educational program of the garden has been developed along two main lines: (1) service to the city, and (2) service to botanical science and education in the broadest sense. As regards the latter, designated also as "World Service," the report says:

> But no institution can render the largest service to its community by remaining local or parochial in its activities and influence. Just as the Botanic Garden owes its existence and maintenance in part to municipal support and is thereby obligated to the city, so, also, every community is under continued indebtedness to the rest of the world, and should contribute in every possible way to the public well-being.
>
> The scientific and educational work of the Brooklyn Botanic Garden has, from the beginning, been developed with these fundamental considerations in mind. Some of the work is unique. In several directions we have had to blaze new trails.
>
> Public response to the opportunities here offered has demonstrated beyond any possibility of question a great public need and the value of such work. If these results shall stimulate the development of similar work in other centers, its success here will be enhanced many fold and will be doubly gratifying to the authorities of the Brooklyn Botanic Garden.

Service to the city is performed in three principal ways: to the schools, to members of the garden and to the general public. The service to the schools, for example, is described in detail according to the following outline:

a. At the Botanic Garden.
  1. Maintenance of labeled collections of living plants, in plantations and conservatories to which teachers may bring or send pupils for study.
  2. Teaching of school classes in
     Classrooms.
     Laboratories.
     Instructional greenhouses.
     Conservatories.
     Plantations.
  3. Lectures to pupils and teachers, illustrated by
     Motion pictures on plant life.
     Stereopticon.
     Living plants.
  4. Consultation and conferences with teachers.

b. At the Schools.
  1. Lectures and addresses by members of the garden staff.
  2. Model lessons.
  3. Loan lectures, including lantern slides and lecture text.
  4. Supply of study material.
  5. Supply of penny packets of seeds for planting in school and home gardens.
  6. Children's horticultural exhibition or fair.
  7. Inspection of school gardens.
  8. Temporary exhibits.

The account of the "World Service" is set forth under the headings: (1) botanical publications, (2) exchange of seeds with other botanic gardens of this and foreign countries, (3) bureau of information, (4) cooperation with national and international organizations. There are appended specimen sheets of lecture bulletins, directions (arranged according to season) for garden walks for school classes, lists of seed packets distributed to the school children of Greater New York City, syllabi of lectures to school classes on such subjects as tea, rubber, chocolate and cocoa, etc. The Brooklyn Botanic Garden on request will send copies of this issue to teachers and others who may be interested in this work.

VISIT OF MME. CURIE TO THE UNITED STATES

MME. CURIE will arrive in this country on the *Ile de France* on October 15 to accept the second gram of radium which her admirers in this country have purchased for her. According to a press notice she will make a trip to St. Lawrence University, Canton, N. Y., to dedicate the Hepburn Hall of Chemistry, before which a statue of her has been erected by the gift of Mrs. A. Barton Hepburn.

The first gram of radium, which was purchased by American admirers of Mme. Curie, was presented to her when she paid a visit to this country in 1921. At the same time a fund was raised which provided an annual income of about $3,500 for Mme. Curie. This gram of radium has been in constant use during the last eight years in the Curie Institute of the University of Paris.

The income of $3,500 a year was intended for the private use of Mme. Curie, who had been living in very humble surroundings, where she was provided barely with the necessities of life. The endowment, however, had no strings on it. Free to use it as she wished, Mme. Curie spent nothing on herself, but devoted the entire income toward the rental of a gram of radium for the Warsaw Cancer Hospital. Warsaw was her native city.

Because Mme. Curie had thus frustrated their effort to make her own life more easy and comfortable, American women friends planned to start another fund to assist her. Mme. Curie, however, vetoed the plan. She said that she was deeply indebted for what this country had done for her and that she could not permit any further solicitation of funds in her behalf.

Her wishes were respected to the extent that no public appeal was made, but a small private agitation was carried on and an amount sufficient to buy a second gram of radium for her use was raised. In the mean time the price of radium has fallen, partly because of economies that Mme. Curie has developed in the technique of obtaining it from radium-bearing minerals.

The gram that was presented to Mme. Curie in 1921 cost $110,000. The second gram cost $50,000. The canvass for this amount was carried on by Mrs. Robert G. Mead, Mrs. Henry Breckinridge, Mrs. Nicholas F. Brady and Mrs. William Brown Meloney.

During her stay in this country Mme. Curie will visit the General Electric laboratory at Schenectady. She will go to Detroit for the celebration of the fiftieth anniversary of Mr. Edison's invention of the incandescent light and will attend a conference on cancer in New York on October 31. The dedication of the new Hepburn Hall of Chemistry at the St. Lawrence University will be held in the latter part of October. She will leave for France on November 8.

It is not intended to hold any public reception for Mme. Curie, because her health will not permit it. The effect of working so long with radioactive substances has been to make her hands extremely tender, and handshaking is an ordeal which she can not undergo. She will pass a day in Washington with the President and Mrs. Hoover, both of whom are old acquaintances.

The gram of radium which is to be presented to her is intended to replace the gram which she now rents for the Warsaw Hospital, thus releasing for her private use the endowment income which now pays the rental for the gram of radium. The first gram of radium was intended as an outright gift to Mme. Curie, but she insisted that papers be drawn making it the property of the Curie Institute at the University of Paris.

SCIENTIFIC NOTES AND NEWS

THE hundredth anniversary of the birth of August Kekulé was celebrated in Bonn on September 7 by the German Chemical Society.

THE honorary doctorate of the Technical Institute at Karlsruhe has been conferred on Mr. Hoover.

JAPAN will join with American and other nations in honoring Thomas A. Edison by sending a delegation to this country with a message of thanks to the inventor for the incandescent lamp. The delegation will be made up of seventeen representatives of Japan's chief electrical organizations.

THE American Ophthalmological Society has awarded the Lucien Howe medal to Dr. Theodor Axenfeld, of Freiburg-i-Br.

DR. WALTER LEHMANN, director of the Museum of Ethnology at Berlin, and Professor Konrad Theodor Preuss have been elected honorary members of the Anthropological Society of Washington.

BRIGADIER-GENERAL LYTLE BROWN has been appointed chief of the Corps of Engineers of the Army. General Brown, who will be automatically promoted from the grade of brigadier-general to major-general, succeeds General Edgar Jadwin. Three new assistants will serve directly under him, one in charge of the flood control work in the lower Mississippi Valley, another in charge of the work on the tributaries to the Mississippi and a third in charge of the work on the Great Lakes.

DR. HERBERT FRIEDMANN, from 1923 to 1926 a National Research Council fellow, has been appointed curator of birds in the U. S. National Museum.

J. F. T. BERLINER has resigned his position with the U. S. Bureau of Mines, after having completed the compilation of the technical data on foreign potash deposits, to become associated with Lazote Incorporated, the du Pont Experimental Station, Wilmington, Delaware.

DR. STUART GRAVES, dean of the school of medicine of the University of Alabama, has been elected temporary acting state health officer of Alabama, during the leave of absence on account of illness granted to Dr. Douglas L. Cannon. He will continue his work at the school, but will spend a considerable part of his time the next few months at the capitol. Alabama plans to expand its present school of medicine into a four-year course, which will cooperate closely with the State Board of Health and the State Department of Child Welfare.

DR. MILO HELLMAN has resigned his position at the College of Dentistry, New York University, to devote his time to more intensive research on problems of odontology and development of the human face.

ANSON MARSTON, dean and director of the engineering department at Iowa State College, has been appointed a member of the committee to survey the route of the proposed Nicaragua Canal.

DR. RAY LYMAN WILBUR, Secretary of the Interior, will deliver the chief address at the dedication of the new Medical School building at the University of Virginia on October 22. The new building was constructed at a cost of more than $1,400,000. Part of it was occupied last spring, but now the entire five-story structure is in use. President Alderman will make the address of presentation and the building will be accepted on behalf of the commonwealth by Governor Harry Flood Byrd. Greetings will be presented by Dr. Wilburt Cornell Davison, dean of medicine at Duke University. Then a statement will be made by Dr. James Carroll Flippin, dean of medicine at the university.

DR. JOSEPH BARCROFT, professor of physiology at the University of Cambridge, will give four lectures under the Edward K. Dunham Lectureship for the Promotion of the Medical Sciences at the Harvard Medical School at 5 P. M. on October 7, 9, 11 and 14. The general subject of the series is "Some Features in the Architecture of Function." The titles of the separate lectures are: "Integrative Adaptation," "The Constancy of the Internal Environment," "The Principle of Antagonism," "Stores of Material."

THE dedication of the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital will take place on October 15 and 16 with the following program. On the first day: Dedication by President Joseph S. Ames; Addresses by Herbert L. Satterlee, president of the William Holland Wilmer Foundation, and by Mrs. Henry Breckinridge. Official inspection of the institute; Signing of the Visitors' Book; Tea; Lecture on "The Development of Ophthalmology in Europe," by Hofrath Ernst Fuchs, of the University of Vienna. On the second day lecture on "Some Contributions and Phases of American Ophthalmology," by Dr. George E. de Schweinitz, of the University of Pennsylvania; Inspection of the institute; Tea; Lecture on "Color Vision and its Anomalies," by Sir John Herbert Parsons, of the University of London.

DR. W. J. BAERG, professor of entomology in the University of Arkansas, and his brother, George Baerg, of Wesleyan University, have returned from a three-months trip to Europe. They visited Germany, Czechoslovakia, Austria and Russia. In the latter they spent some time in Leningrad, Moscow, and in rural districts of the republics of Ukraine and Crimea.

DR. HIDEOMI TUGE, of Tohoku Imperial University, Sendai, Japan, is expected to arrive at the Wistar Institute during the present month. He will carry on his neurological research under the direction of Dr. George E. Coghill. Dr. Tuge will be laboratory guest of the Wistar Institute for the coming two years.

DR. H. S. REED, professor of plant pathology in the Citrus Station of the University of California, has leave of absence beginning on February 1, 1930, during which he plans to visit the citrus districts of the Mediterranean district to acquire familiarity with cultural practices and with problems arising where trees have been cultivated over a long period of years. At the University of Geneva, he will work with Professor Robert Chodat on the dynamics of the growth process, and will give a series of lectures there. He plans to visit the Agricultural College of Holland at Wageningen and may lecture there.

PROFESSOR A. L. KROEBER, chairman of the department of anthropology at the University of California, has returned from a nine weeks' stay in northwest Arizona, where he took part in the first anthropological summer school sponsored by the John D. Rockefeller, Jr., anthropological field station which will soon be established at Santa Fé, New Mexico. Mr. Rockefeller has set aside $200,000 for the erection of an anthropological field laboratory which will serve the same purpose in ethnology, or the study of man and his culture, as do such laboratories as that at Woods Hole, Massachusetts, and the California Scripps Institution of Oceanography at La Jolla. It will be an open house for the use of ethnologists from all parts of the world. It is hoped that the station

will sponsor summer courses for graduate students every year as it did this year.

Huron H. Smith, botanist at the Milwaukee Museum, will spend three months on the Oneida Indian reservation near Green Bay, Wisconsin, studying the aboriginal uses of plants. This is the sixth and last study to be made of the six Wisconsin Indian tribes, Menominee, Chippewa, Fox, Pottawatomi, Winnebago and Oneida.

In honor of Professor Robert W. Hegner, professor in the Johns Hopkins University, Baltimore, who has been visiting in Japan, a lecture and meeting, proposed by some of his Japanese friends, including Drs. S. Gto, H. Hayashi, T. Kitajima and M. Nagayo, were held recently in the Tokyo Imperial University.

Dr. George Paget Thompson, professor of natural philosophy in the University of Aberdeen, is George F. Baker non-resident lecturer in chemistry at Cornell University.

Professor Emanuel Fritz, of the University of California, is exchange professor in the department of forestry of Cornell University, taking the place of Professor A. B. Recknagel, who will fill for the year Professor Fritz's place at California.

Dr. Ernst Pick, professor of pharmacology of the University of Vienna, will deliver the first Harvey Society lecture at the New York Academy of Medicine on Thursday evening, October 3, 1929. His subject will be "The Regulation of Water Metabolism."

The annual report of the British Science Guild announces that the Norman Lockyer Lecture for 1929 will be given on November 19 by Sir Walter Fletcher, whose subject will be "Certain Aspects of Medical Research and their Applications."

Dr. Walter Lehmann, professor of American ethnology at Berlin, recently gave a series of lectures at the University of Buenos Aires on old Mexican religions.

The seventy-fourth annual International Exhibition of the Royal Photographic Society is being held at the society's house from September 14 to October 12.

The Sixth International Conference on Psychotechnics, which it was planned to hold in Barcelona, Spain, from September 25 to 29, has been postponed until April, 1930.

In cooperation with the newly organized Pacific Institute of Tropical Medicine of the University of California Medical School, the department of pharmacology is starting an investigation of the use of organic arsenicals for the control of amebic dysentery under the direction of Dr. C. D. Leake, head of the department of pharmacology, in consultation with Dr. A. C. Reed, professor of tropical medicine. The experimental work will be done by Dr. H. H. Anderson, research fellow in pharmacology.

Dr. H. V. Arny, chairman of the committee on colored glass containers of the American Pharmaceutical Association and professor of chemistry at the college of pharmacy of Columbia University, announces the completion of a $2,000 fund creating a two-year fellowship designed for the study of the deterioration of chemicals and pharmaceuticals under the influence of light. Mr. Abraham Steinberg, Seabury Prize Scholar of Columbia University College of Pharmacy, has been appointed fellow.

An Associated Press dispatch reports that the Pan-American Institute of Geography and History has appointed committees to fix assessments and take care of other details of the institute which was founded on September 17. Delegates of nearly all countries of North and South America were present at the founding. Mr. William Bowie, delegate from the United States, offered the assistance of the National Geographic Society in the work of the institute.

Plans for the new psychiatric hospital to be built by New York City on the block bounded by the East River, First Avenue, Twenty-ninth and Thirtieth Streets have been completed and work will be started immediately according to an announcement made by Commissioner of Hospitals William Schroeder, Jr. The new hospital will cost between $3,500,000 and $4,000,000, and will replace the old psychopathic wards of Bellevue Hospital. It is expected that the building will be opened for use within two years.

Announcement of plans for the annual award of the Francis J. Clamer medal, in recognition of the most distinguished achievement in the field of metallurgy, was made by the National Association of German-American Technologists at its forty-fifth annual meeting recently held in Philadelphia. The medal is provided from an endowment of $1,000 established by the founder of the Ajax Metal Company for the purpose of promoting researches into new uses and employments of metals.

Under the will of the late James B. Ford, the New York Botanical Garden receives an unconditional legacy of $25,000. Mr. Ford was a life member and a patron of the garden for several years. Another legacy of $10,000 was received under the will of the late Miss Mary Ann Dill. Miss Dill was one of the first annual members of the garden, her membership dating from 1896.

THE library of the school of tropical medicine of the University of Porto Rico under the auspices of Columbia University has been presented with the twenty-four volume set of Saccardo's "Sylloge Fungorum," a notable work in Latin which contains the description and classification of approximately 140,000 species. The cost of these volumes is practically prohibitive for most medical libraries and their gift to the School of Tropical Medicine by Dr. William J. Matheson (Matheson Encephalitis Commission), of Manhattan, was for the purpose of stimulating developments in tropical mycology in Porto Rico.

UNIVERSITY AND EDUCATIONAL NOTES

FOUR new buildings, completed at a cost of more than $1,400,000, are ready this autumn at the University of Pennsylvania. Chief among the structures is the Martin Maloney Memorial Medical Clinic of the University Hospital, which was built at a cost of $1,000,000 largely through donations from the late Martin Maloney. The other buildings are the Ward, Warwick and Chestnut dormitories, which have been built at the southeast end of the large dormitory quadrangle. Their total cost was about $400,000.

DR. JOHN A. MILLER, of Swarthmore College, is retiring from teaching and administrative work to become research professor of astronomy. He will continue in charge of the Sproul Observatory and will devote his time to a study of certain problems connected with the corona of the sun. Dr. Arnold Dresden, of the University of Wisconsin, succeeds Dr. Miller as head of the department of mathematics and astronomy.

GEORGE FRANCIS BASON, assistant professor in the department of electrical engineering at Cornell University, has become head of the department of electrical engineering in the University of North Carolina.

DR. ROBERT S. STONE has been appointed assistant professor of roentgenology at the University of California Medical School; Dr. Henry H. Searls has been promoted to associate professor of surgery; Dr. Gordon E. Hein to associate professor of medicine, and Dr. Randolph L. McCalla to assistant professor of medicine.

DR. LLOYD W. FISHER, of Reading, has been appointed professor of astronomy and geology at Bates College to succeed Professor Frank D. Tubbs, whose resignation was accepted last commencement after twenty-two years' service.

DR. REGINALD H. PEGRUM, who formerly divided his time between the University of Buffalo, as assistant professor of geology, and the Buffalo Museum of Science, as curator of geology, has resigned from the latter institution to accept a full-time appointment at the university. As research associate in geology of the Buffalo Museum of Science, he will continue his geologic studies in connection with the Lake Erie Survey begun in 1928.

M. FLAMANT, professor in the faculty of Clermont-Ferrand, has been appointed professor of general mathematics in the University of Strasbourg to succeed M. Cerf.

DR. VICTOR M. GOLDSCHMIDT, of Oslo, Norway, has been called to a professorship of mineralogy at the University of Göttingen.

DISCUSSION

A NEW SPECIES OF MONO-MUCOR, MUCOR SUFU, ON CHINESE SOYBEAN CHEESE

THE utilization of fermentation micro-organisms was known so early in China that we can trace it back to the Hsia Dynasty, 2000 B. C. Indeed our ancestors had applied these organisms to a wide range of uses. Many tasty foods and drinks and valuable medicines, the manufacturing methods of which were invented and improved upon by our ancestors, are still produced in every part of our country. From the scientific point of view, the old manufacturing methods seem to be fundamentally sound. For example, the regulation of temperature, the purity of the culture and the means of pasteurization and preservation are conducted so skilfully that we can not but be impressed with the painstaking and accurate observations on natural phenomena in the past. The application of a mono-mucor in the manufacture of "sufu" is such an example.

"Sufu" or "tosufu" is a well-known dish in the Chinese dietary. It is made from soybeans and is sold everywhere in groceries. The method of manufacture is handed down from generation to generation. At first soybeans of selected quality are cleaned with water and ground in a stone mill into a milky paste, which is then heated to the boiling-point and filtered through linen cloth. With the addition of a suitable quantity of brine the protein is

coagulated into a curd known as "tofu." The tofu is pressed in wooden molds into blocks of desirable sizes, which are then arranged on bamboo trays and left in the fermentation chamber for about a month. The manufacture of sufu begins in December and ends in February. The average temperature of the fermentation chamber is found to be 14° C. After this treatment these blocks are transferred to large earthenware barrels, each having a volume of seven hectoliters. Then salt and Shoushing wine are added one after the other to the blocks, mainly for the purpose of preservation. The barrels are finally closed, covered with wooden plates and left unopened for about three months. After this procedure the blocks, having acquired a peculiar flavor, are ready for sale. The products seen on the market are usually red or white blocks 2 to 4 cm square and 1 to 2 cm in thickness. The white ones are untreated, while the red ones are colored with "hung chu," which is derived from the culture of another mold, *Monascus purpureus*, on rice.[1]

Sufu is manufactured in large quantities in the region of Shoushing in Chekiang Province and Soochow, Wushih, and Changchow in Kiangsu Province. The native manufacturers know how but not why such flavored sufu is produced. They believe that the fermentation is controlled by one of the gods, to whom they make prayers for its success.

Early in my research on sufu I found in the fermentation chamber of a factory in Shoushing gray mycelium about 2 cm in height covering the whole surface of the blocks. As I deemed this mycelium to be valuable for scientific research, I made a culture of it on the spot and brought the culture back to Nanking. The mold which produces this mycelium was isolated. It appears to be an undescribed species of Mucor for which the name *Mucor sufu* is proposed.

The mycelium produced by the mold is white at first but later becomes grayish yellow, the culture media being soybean-agar, koji-agar and tofu. There are no septa in the hyphae. Single aerial hyphae with spherical sporangia are developed from the mycelium. The sporangium when old is grayish-yellow in color and on its surface has neeedle-shaped crystals of calcium oxalate. The columella is also spherical. The diameter of the sporangium is 14.61μ to 28.42μ, and that of the columella is 8.12μ to 12.08μ. The sporangiospores are elliptical in shape with smooth surfaces and have a dimension of 4.9μ–12.58μ x 3.24μ–8.0μ. Soybean is a good medium for the culture of the mold. On bread or boiled rice the mold develops very imperfectly. For sucrose, glucose, fructose, maltose, mannose, lactose, galatose, raffinose, arabinose and xylose it has no fermentation power. It does not liquefy gelatin culture media but causes soybean juice to be slightly acidified and coagulated. On observing under a microscope a cross-section of sufu made from the pure culture of the mold on tufu, one can see that the mycelium of the mold has penetrated the sufu to the center. The optimum temperature for the growth of the mold is 29° C. The mold does not produce rhizoids. It is a mono-mucor.

From the observations recorded above I conclude that the transformation of tofu into sufu is due to the growth of this Mucor. It is also interesting to note that the mono-mucor on sufu manufactured in Shoushing in Chekiang Province and that in Soochow, Wushih, and Changchow in Kiangsu Province is all of the same species. In ancient times traveling was handicapped by lack of railway connections between Chekiang and Kiangsu, nearly three hundred miles apart. It is remarkable that the mold on sufu manufactured in these two provinces should be of the same species, a coincidence of historical as well as biological importance.

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CONCERNING HETEROTHALLISM IN PUCCINIA GRAMINIS

IN 1927, J. H. Craigie[1] published evidence of heterothallism in *Puccinia helianthi*, and in 1928[2] extended the work to other rusts, including *Puccinia graminis*. He reported that, in the haploid generation, isolated mycelia produced pycnia but, in the great majority of cases, no aeciospores. If two mycelia coalesced or if pycniospores of one infection became mixed with pycniospores of another, approximately 50 per cent. of the combinations resulted in the production of aeciospores. This led him strongly to the belief that haploid mycelia and pycnia are either (+) or (–) and that the diploid generation is initiated when (+) and (–) meet.

A cytological study of infections of *Puccinia graminis* on the European barberry adds weight to this hypothesis. An isolated infection consists of haploid mycelium and pycnia. Abundant pycniospores are formed and the drop of pycnial exudate on the upper surface of the leaf is maintained for five or six weeks or even longer. Structures resembling aecia form at the normal time and place, but they

[1] For an account of experiments by Margaret B. Church on the production of this red coloring matter, see *Journal of Industrial and Engineering Chemistry*, 12: 45–46, January, 1920.

[1] "Discovery of the Function of the Pycnia of the Rust Fungi," *Nature*, 120: 116–117 and 765–767. 1927.

[2] "On the Occurrence of Pycnia and Aecia in the Rust Fungi," *Phytopathology*, 18: 1005–1015. 1928.

consist of haploid mycelium only. They grow and undergo the first differentiation into an outer half of large, rounded empty cells and an inner half of small, dense living cells. Ordinarily no spores are produced, and after further expansion the whole structure dies.

After pycniospores of different infections have been mixed, a study of the pycnia reveals the presence of binucleate cells in the upper part of the wall of the pycnium near the base of the paraphyses. Leading downwards from this area are hyphae whose cells contain either two or three nuclei, and sometimes more. Binucleate cells can be found also at the base of the pycnium. In the area between the pycnium and a young aecium, there is a mixture of many haploid and a few diploid hyphae.

The aecium begins as a loose tangle of hyphae, predominantly uninucleate, but usually including a few binucleate cells. In later stages binucleate cells are regularly present, scattered here and there in the haploid mass. As the time of aeciospore formation approaches, the centrally located diploid cells enlarge, often becoming multinucleate as they look outwards towards the lower surface of the leaf. These become the basal cells of the spore chains, which, when fully organized, consist of regularly binucleate cells. In older infections where successive aecia are forming, diploid hyphae can be found between the older and the younger aecia. As soon as aeciospore formation begins, the formation of pycniospores is checked and the pycnial exudate dries.

A more detailed study is in progress.

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A USE OF JOURNALS BY RESEARCH MEN

A PORTION of the article by Dr. B. R. Andrews on "Budget Needs of College Teachers," in SCIENCE, No. 1802, page 20, recalls a method which contributes to the more efficient use of journals by research men. The writer has seen this system used in two different institutions with very satisfactory results, and its general adoption might be a temporary means of somewhat relieving the situation described by Andrews.

The method mentioned attempts to bring to each research man (and teacher) all the journals in which he is interested very soon after they reach the institutional library, and give him opportunity to read the articles of most immediate interest and list others for early reading.

Each man, including graduate students, in a college or in a department, if large, lists the journals which he wishes to read in the order of his preference for them. These lists are compiled by a member of the library staff or by the secretary of the department. A library helper visits the desks of all men wishing any of the journals at regular intervals, perhaps twice a week. As each journal is received by the library, it is taken by the helper on his next trip to the desk of the man most interested. As the helper makes the regular rounds, he collects all the journals which were distributed on his previous visit, and redistributes them, leaving each journal on the desk of the man whose name is next on the list for that particular journal. It takes a helper four to five hours a week to distribute the journals, from two or three to fifteen per man, to thirty-five men twice a week.

The fact that a research man has the journals in which he is most interested, or as many of them as are taken by the institutional library, coming to his desk and remaining for a limited time is an opportunity and a stimulus to keep abreast of the developments in his particular field.

J. L. ST. JOHN

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FUNCTIONS OF REVIEW JOURNALS

THERE has recently come to hand from an enterprising German publishing house a prospectus of various medical review journals or "Referatenblätter" (Zentralblätter, Zeitschriften, Berichte, Jahresberichte). These journals are excellent for the purposes for which they were originally intended—several Berichte I should not like to do without. They enable one to read more discriminately; but that they might be considered short-cuts or "royal roads to learning" had not occurred to me. Hence my surprise on reading on page 4 of the prospectus referred to the following paragraph:

> . . . Die Zentralblätter sollen den Bezug der ausländischen Litteratur, wenigstens für die deutschen Leser, überflüssig machen, und es wird besonders darauf gesehen werden, dass die *wichtigen* ausländischen Arbeiten so ausfürlich referiert werden, dass ein Einblick in das Original im allgemeinen entbehrlich erscheint.

One wonders whether biological literature is not thus behaving like the legendary dragon-fly that swallowed itself, beginning at the abdomen. Can one afford to ignore the basic journals, including the German ones, or shall we discount the statement of the prospectus as an overenthusiastic expression of nationalism? To my notion there is no danger to the substantial biological literature, for after all a review is a review, a Referat a Referat. One can not afford to get one's information second hand in any field of research; hence the value of review journals will always be limited.

The aims of *Biological Abstracts* are more praiseworthy in this respect, I think. These are, as I understand them, to enable the reader to read more, not less; to enable him to read more widely by furnishing titles and references and to read more discriminatingly by adding a brief statement of scope of work covered and conclusions drawn, and to give such indexes as to provide a dependable orienting mechanism. More lengthy "Berichte" will continue to fit into the scheme, especially in helping one keep in touch with related fields (Grenzgebiete) and other fields in which one happens to be an interested amateur.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

NEW TECHNIQUE FOR COLLECTING INTESTINAL ROUNDWORMS[1]

THE isolation of small roundworms from the intestinal contents of host animals is recognized as a difficult and tedious task. As the intestine loses the body heat, the mucous secretions from the intestinal glands pour into the spaces between the villi and soon all other material in the lumen of the intestine becomes imbedded in viscid, opaque mucus, which not only obscures any small nematodes present, but renders their isolation difficult. Experimental studies on the larvae of ascarids and closely related forms which do not become attached securely to the intestinal mucosa have led to the plan of keeping the host animals off feed before autopsy, of prompt removal of intestinal contents and of the use of mucus solvents. But in spite of these precautions, the isolation of the larvae has been a slow, laborious process.

During the past year while working with larvae of the large roundworm (*Ascaridia lineata*) of chickens some new features were added to the technique which so greatly facilitate the removal and isolation of the young worms that it seems desirable to make a record of them. By the new method the experimental birds are kept off feed over night, or for six hours prior to autopsy, to decrease the volume of intestinal contents. After the bird is decapitated, the small intestine (habitat of the nematodes) is quickly removed, stripped of its mesenteries and other appendages and divided into portions approximately a foot in length. Each portion is then flushed with hot water under pressure, to remove the contents before the intestinal glands become active. In flushing, one end of the intestine is held over the flushing cone (Fig. 1, *a*) and the other end inserted into an Erlenmeyer flask. The amount and pressure of the hot water admitted into the intestine are such as to distend but not rupture the walls of the intestine. This enlarges the spaces between the villi, and thus permits free hydraulic action on all the intestinal contents. These contents from each bird are placed in a glass jar and preserved in 4 per cent. formol. To remove the worms the material is decanted, stained with Jenner's stain, poured into a shallow moist chamber and examined with low-power binoculars. The white worms, which do not readily take up the stain, stand out in contrast to the blue intestinal débris.

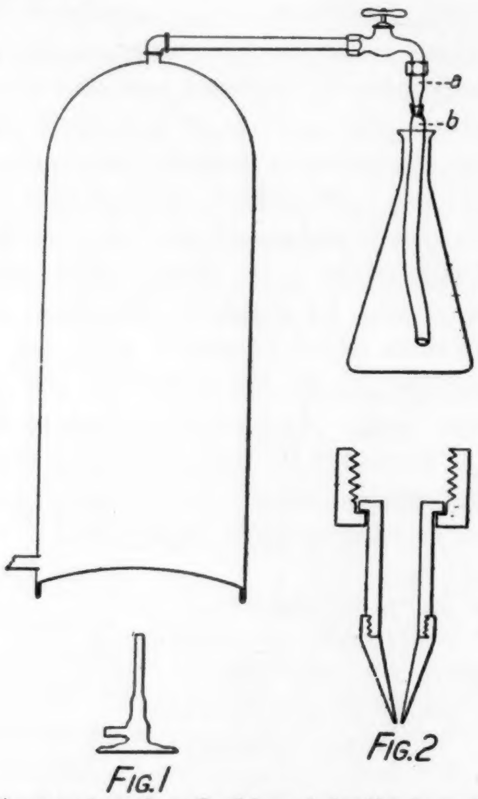

FIG. 1. Apparatus for flushing intestinal contents. *a*, flushing cone; *b*, portion of intestine showing distention due to pressure of water.
FIG. 2. Details of flushing cone.

The question of the efficiency of this method was, of course, one of the first to arise. In several preliminary trials, young worms were readily isolated from the flushed contents, but were not found in scrapings from the walls of the flushed intestines. Arrangements then were made for definite tests, and two experiments were carried out. After flushing the intestines in the usual way, they were slit open, the mucosa scraped, the material teased apart and examined with the aid of a binocular microscope.

In the first experiment, the individual chickens were parasitized at the age of five weeks by the administration, *per os*, of fifty embryonated eggs of the nematode. Eight weeks later a second feeding of embryo-

[1] Contribution No. 115 from the department of zoology, Agricultural Experiment Station, Kansas State Agricultural College.

nated eggs was given and after three weeks the experiment was terminated. Examination of the flushed intestinal contents of the fifty-seven chickens gave 133 nematodes, whereas in the scrapings of the intestinal mucosa no worms were found in any case. The technique worked admirably with both small and larger worms, the range in length being from 3.2 mm to 95.2 mm. Numbers of worms likewise caused no difficulty, for as few as one and as many as twenty-five worms were present in a chicken. Thirty-three per cent. of the birds were infested at autopsy.

In the second experiment, thirty chickens were parasitized at the age of nine weeks by giving to each bird fifty embryonated eggs of the nematode. Two weeks later the experiment was terminated with results similar to those of the first experiment, *viz.*, that from the flushed intestinal contents 186 worms were isolated, while in the scrapings of the mucosa of the same intestines not a worm was found. The percentage of infested birds in this experiment was 92; the range of individual infestations was from one to thirty-three worms, and the lengths of the worms varied from 2.1 mm to 11.5 mm. The results of these experiments give evidence that the technique is highly efficient in the removal of roundworms from the intestines of chickens.

The temperature of the water for flushing the intestine may vary many degrees and still be effective. Temperatures above 60° C. and below 35° C. caused contractions of the muscles of the intestine and thus interfered with distention and free flushing.

While the technique is especially valuable for small worms, it works equally well with larger ones, and should be readily adapted to studies on the various larval and adult nematodes, living free in the small intestine of birds and reptiles and of small and medium-sized mammals. Apparatus such as shown in Fig. 1, while desirable, is not necessary for the application of this technique. The flushing cone (Fig. 2) can be used on any hot-water faucet to which a hose couple can be attached. It was made by threading a small brass cone on a hose couple.

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PARAMECIUM BURSARIA AS A LABORATORY DEMONSTRATION OF CYCLOSIS

THE use of *Paramecium bursaria* for demonstration of cyclosis in laboratory classes in zoology has several possible advantages, as compared with the customary use of Nitella. In the first place, it obviates the necessity for drawing on the plant kingdom for illustrative material. Furthermore, this ciliate may be maintained easily in laboratory cultures at any season of the year, and in addition it furnishes, with its contained Chlorella, an excellent example of symbiosis.

Cyclosis is unusually rapid in this species of Paramecium, and is readily followed under a 4 mm objective. The writers have found that especially interesting preparations may be made by staining vitally with neutral red. Clean slides, after being warmed slightly over a flame to eliminate excess moisture, are filmed with a solution of neutral red (1:1500, or more dilute) in absolute alcohol. After the film has dried a drop of culture material is added, and a cover-slip sealed in place with melted vaseline. Numerous small scattered globules are stained with neutral red, and these add to the clearness with which cyclosis may be observed. In addition, this method affords a good laboratory demonstration of the effects of vital dyes on a protozoon, while the neutral red also serves as an indicator of the pH of the inclusions. If the dye solution is dilute enough, the organisms should live for twenty-four hours or more; hence, if several laboratory sections are to be supplied, the same preparations may be used in successive laboratory periods.

R. F. NIGRELLI,
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UNIVERSITY COLLEGE,
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SPECIAL ARTICLES

MICHIGAN PAPYRUS 620; THE INTRODUCTION OF ALGEBRAIC EQUATIONS IN GREECE

THE Egyptians some two thousand years before the Christian era set up equations of a purely algebraic type. In one type of these problems, as given in the Ahmes Papyrus,[1] an unknown number with some fractional part of it is set equal to a known number and the solution is effected by the so-called method of false position. In other problems[2] two unknowns appear as the sides of a rectangle with known area, and their ratio being given, the two unknowns are determined. The brief translation of portions of the Moscow papyrus given by Touraeff[3] also indicate that the analogous problems which appeared in Euclid's Data had their beginnings in ancient Egypt. The eagerly awaited complete trans-

[1] T. Eric Peet, "The Rhind Mathematical Papyrus," Liverpool, 1923.

[2] H. Schack-Schackenburg, "Der Berliner Papyrus 6619," *Zeitschrift für Ägyptische Sprache und Altertumskunde*, Vol. XXXVIII (1900) and Vol. XL (1902).

[3] B. Touraeff, "The Volume of the Truncated Pyramid in Egyptian Mathematics," "Ancient Egypt," 1917, pp. 100–102; L. C. Karpinski, "An Egyptian Mathematical Papyrus in Moscow," SCIENCE, 57 (1923): 528–529. In the article in SCIENCE I pointed out the importance of the other problems to which Touraeff refers. L. C. K.

lation of the Moscow papyrus will doubtless throw further light on these questions.

In Greece the geometrical version of the linear equation in one unknown appears in the first book of Euclid with the problem to construct a parallelogram (or rectangle) given the area and one side. This is given as the beginning of the theory of the application of areas and is elaborated in the sixth book of Euclid, as well as in Euclid's Data, leading in effect to the geometrical solution of different types of quadratic equations in one unknown as well as to the construction of the pentagon. In the second book of Euclid the theorem on the division of a line into equal and unequal parts leads also, in effect, to the solution of a quadratic in one unknown. Notably by this method undoubtedly the Pythagoreans achieved the division of a line into extreme and mean ratio and the solution of the construction with ruler and compasses of the pentagon.

There is, then, indeed, a great amount of algebraic material in Euclid, and in the works of Archimedes and Apollonius. Books seven to ten of Euclid's Elements are entirely arithmetical and algebraical, clothed to some extent in geometrical form. The work of Diophantus of Alexandria appears in the third century of the Christian era with an immense amount of strictly algebraical material, free from any geometrical implications. This material and the algebraic problems of the Greek Anthology[4] are so different from the algebraical material as found in the works of the classical Greek authors that the transition must have involved the activity of many Greek students of mathematics from the time of Archimedes to the time of Diophantus.

The late Professor Francis W. Kelsey acquired in Egypt in 1921 a Greco-Egyptian papyrus which is confidently dated as not later than the second century of the Christian era. There are in this papyrus three algebraical problems which in their formulation, solution and notation mark a notable advance over the problems of ancient Egypt of which these problems are the continuation.

Writers on the history of algebra have long known that material of the type given by Diophantus must have developed in the period between that writer and Euclid. A series of algebraic problems in one unknown, or easily reducible to one unknown, is found in the Greek Anthology. These problems were largely preserved in the writings of the grammarian Metrodorus, who flourished five centuries after the beginning of the Christian era. Several of these problems relate to the distribution of apples and nuts, leading to first degree equations. Thus, the twelfth problem[5] leads to the equation

$$\frac{x}{5}+\frac{x}{4}+\frac{x}{19}+\frac{x+\frac{x}{20}}{10}+12+120=x.$$

Now Plato refers to problems connected with bowls and apples, from which Heath[6] concludes that problems of this type go back to the fifth century B. C. It is worthy of note that in the commentary on the Charmides discussing the Greek logistic reference is made to the Egyptian method of multiplication. Elsewhere Plato[7] refers to the fact that the Egyptians teach their children arithmetic by means of games such as those involving the distribution of apples.

A system of solving a series of n simultaneous linear equations in n unknowns is described by Iamblichus[8] in his Commentary on the arithmetic of Nicomachus. This rule is called the "flower" or "bloom" of Thymaridas,[9] an ancient Pythagorean.

A further series of simultaneous equations is associated with the name of Heron.[10] These involve the perimeter and areas of rectangles and further rational right triangles in which the sum of the area and the perimeter is given. So far as the rectangles are concerned it is interesting to note that here again we have ancient Egyptian problems of a similar nature, as noted above. These problems also are not dated and it is on internal evidence that Heath concludes[11] that the original formulation falls in the period between Euclid and Diophantus.

The Greek symbol for the unknown quantity which is used in the Michigan papyrus appears also in manuscripts of Diophantus. Concerning this symbol there has been much speculation.[12] Heath has made the suggestion that "this is the contraction for the two initial letters of ἀριθμός and that Diophantus may not have made the contraction himself." This agrees with the symbol as found and used in the Michigan papyrus, although it must be said that here the symbol seems to be used not simply as a "tachygraphic abbreviation" but somewhat as an algebraic symbol like our x.[13]

The Greek text is to appear shortly in *Classical Philology*.

4 See G. Wertheim, "Die Arithmetik und die Schrift über die Polygonalzahlen der Diophantus von Alexandria," (Leipzig, 1890), Appendix III, "Die arithmetischen Epigramme der griechischen Anthologie."

5 G. Wertheim, "Die Arithmetik und die Schrift über die Polygonalzahlen der Diophantus von Alexandria," Leipzig, 1890, p. 334.

6 "A History of Greek Mathematics," Oxford, 1921, Vol. I, p. 14; Vol. II, p. 442.

7 Laws 819 A-C.

8 Iamblichus, In Nicomachum, p. 62. 18.

9 See Heath, "History," Vol. I, pp. 94–96.

10 Heiberg and Zeuthen, *Bibliotheca Mathematica*, VIII 3, 1907–1908, pp. 118–134.

11 "History," Vol. II, p. 447.

12 Heath, "Diophantus of Alexandria," second edition (Cambridge, 1910), pp. 32–37.

13 See also Cajori, "A History of Mathematical Notations" (Chicago, 1928), Vol. I, pp. 71–72.

The papyrus is a roughly rectangular piece, about 210 mm broad and 125 mm from top to bottom in its greatest dimensions. The top margin is preserved, and some fifteen lines of the text and accompanying calculations of two columns of mathematical problems; the full breadth of the left-hand column is there, but only the left half of the right-hand column. The text itself clearly shows that each of the problems consisted of at least three parts, the hypothesis in which the conditions of the problem were stated, the solution, and finally the check (*apodeixis*), in which it was shown that the values derived in the solution would satisfy the conditions laid down in the hypothesis. After each problem there were appended the calculations, in ordinary Greek numerical notation, involved in the solution. What we have left in the preserved fragment includes, in Column i, the very end of the solution of one problem, the check complete and the calculations very nearly complete; in Column ii, the last two and a half lines of the solution of a second problem, its check and a good share of the calculations, followed by the hypothesis and the first line or two of the solution of a third. In explanation of the translation which follows attention should be drawn to the use of a symbol very unusual, perhaps unique, in the papyri, which, however, as stated above, appears in the manuscripts of Diophantus to stand for x, the algebraic unknown.[14] In the form it closely resembles both the abbreviation for "drachma," which occurs frequently in the Greco-Egyptian papyri, and the Greek numeral 6, but it can have neither of these significances in P. Mich. 620. It is supposed to be ultimately an abbreviation of the Greek word *arithmos*, "number," and in this papyrus can apparently mean both "number," "quantity," and "*the* number," that is, the number we are seeking, the unknown. The contents of the papyrus are as follows:[15]

COLUMN i

Four numbers: their sum is 9900; let the second exceed the first by one seventh of the first; let the third exceed the sum of the first two by 300, and let the fourth exceed the sum of the first three by 300; to find the numbers[16]. . . . *To get the value* of the fourth number, again *take* 150 *30 times; it gives* 4500; and the 600[17] in its assigned value make 5100; this is the fourth number. Add the *four* numbers; $1050 + 1200 + 2550 + 5100 = $ *9900*. Check. Since it says, "Let the second number exceed the first by one seventh," take one seventh of the first, 1050; it is 150; *add this* and 1050; this gives 1200, which is the second number. Again, since it says, "Let the third exceed the first two by 300,"[17] add the first and *second; it gives* 2250; and add the 300[17] of the excess; it gives 2550, which is the third. And since it says, "Let the fourth exceed the first three by 300,"[17] add the three; it gives 4800; and the 300[17] of the excess; this makes 5100, which is the fourth number.

1/7		300[17]	300[17]	9900[17]
7x	8x	15x + 300	30x + 600[17]	
1050	= 1200	2550	*5100*	
150				

COLUMN ii

. . . Since the second number is *four times* the first, *multiply* 4×42; it gives 168; *and add the 12 of the excess, which gives 180;* this is the second number. Check. *Take one sixth of the second number;* it is 30; but add 12; it is 42, which is the first number; *and multiply 42 by 4*, which is 168; then add 12; it gives 180, *which is the second number.*

1/6(?)	+ 12[18]	4	12[18]
x		$4x$	
1/3 = 14[18]		2×42	= 2 . . .
42		168 + 12	= 180

Three numbers. The sum of the three is 5300. Let *the sum of the first and second* be 24 times the third, *and let the second*[19] *be* 5 times the first. *To find the three numbers.* . . . Inasmuch as the first and the second *are 24 times the third*, therefore the sum of the three is *25 times the third. Divide 5300 by* 25 and it gives 212, *which is the third number.* . . .

In the form of solution of these algebraic problems we have a remarkable approach to modern algebraic symbolism. The problems themselves are strictly algebraic and in conception logical continuations of such a problem as that of the Ahmes papyrus, "a quantity and its seventh, it makes nineteen." These problems connect also in idea with the problems found in the Liber Abbaci of Leonard of Pisa (A. D. 1202) and current in Italian arithmetics from his time on for centuries.

Among the Arabs Al-Karkhi gives the following problem:[20]

If the first of four men receives from the second one dirhem he will have the double of what the second has

[14] Heath, "Greek Mathematics," II, 456–457.

[15] The italics indicate words, numbers and phrases supplied to fill lacunae. In the calculations, the signs of addition and multiplication are supplied; the papyrus has the sign of equality.

[16] This is the hypothesis of the first problem, entirely missing from the papyrus, but quite easy to restore from the quotations from it made in connection with the check, and from comparison with the third problem.

[17] In each of these cases the numeral is preceded by the symbol mentioned above used in the manuscripts of Diophantus to indicate the unknown term. Here it seems to mean simply "the quantity" and may be disregarded in translation. The same symbol occurs in the second line of the calculations, however, as the algebraic x.

[18] The numerals thus marked are preceded by an abbreviation which probably stands for *monades*, "units."

[19] "Let the second and third," etc., from the point of view of the Greek, is perhaps an easier and better restoration. This, however, would necessitate a fractional solution, which seems to be avoided in the other two problems.

[20] F. Woepcke, "Extrait du Fakhrī, Traité d'Algèbre par Abou Bekr Mohammed ben Alhaçan Alkarkhi" (Paris, 1853), pp. 139–141.

remaining; if the second receives from the third two dirhems, he will have triple what the third has remaining; if the third receives from the fourth three dirhems he will have four times as much as remains with the fourth; and finally if the fourth receives from the first four dirhems he will have five times as much as remains with the first. How much does each one have?

For several centuries algebra was taught in Europe employing such problems.

By this important document a noteworthy link is placed in the chain which connects the mathematics of early Egypt with Greece and with the algebra of the Hindus, of the Arabs and of our European predecessors in this field.

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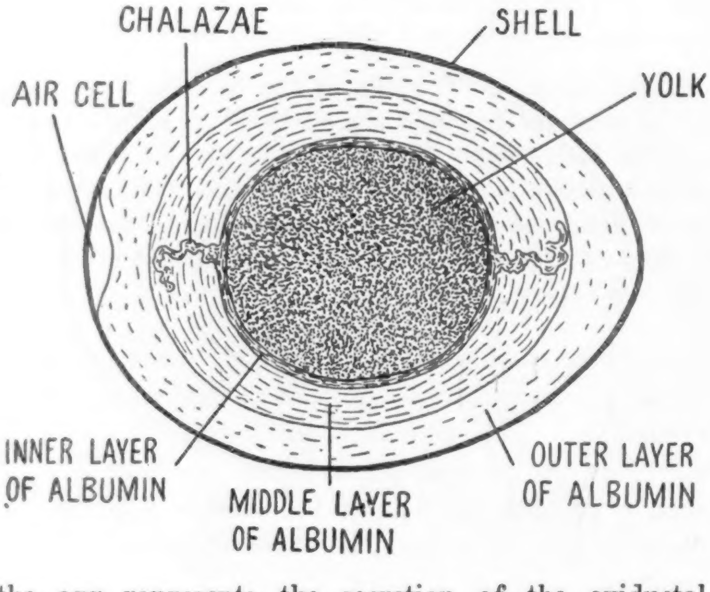
THE DRY MATTER IN DIFFERENT LAYERS OF EGG ALBUMIN

IF a fresh hen's egg is opened in a careful manner, there can be distinctly observed with the naked eye the three different layers of albumin: outer, middle and inner, as shown on the diagram. The albumin of



the egg represents the secretion of the oviductal glands. It is a complex mixture of organic and inorganic matter. The histology of the albumin is not exactly known, but the very probable theory has been advanced that it consists of a network of fibers containing fluids in their meshes.

The process of formation of albumin is in an intimate relation with the yolk of the egg—to complete the female reproductive cell. When the yolk of the egg or ova leaves the ovary it has a slow revolving movement which is controlled by the peristaltic contraction of the oviduct of the hen. In that long passage-way the yolk of the egg gets its threefold covering of albumin from certain portions of the oviduct. In the upper glandular part of the oviduct is secreted the innermost layer of albumin, which is especially dense and forms a sort of membrane over the yolk. It also extends from each side of it as a twisted cord, the chalazae (see diagram). Later in the passage the second layer or fluid albumin is secreted, which lies next to the dense one. And finally, when the yolk is almost at the end of the long journey—in the area of partially formed shell—the third, watery layer of albumin is formed.

The quantity of the different layers of albumin described above has been studied, and the following table gives an illustration of the relative amounts of fresh albumin of all the three layers in grams and in percentages:

	Outer	Middle	Inner	Total
Amount in grams:	12.81	18.43	.97	32.21
Amount in percentages:	39.8	57.2	3.0	100.0

Their physical characteristics suggest that the water content is very likely to be different.

A little experiment has been carried out in our laboratory of experimental embryology to determine quantitatively the dry matter content in the different layers of albumin. A simple method was employed for the determinations. The egg was broken into a saucer, and each layer of albumin was pipetted into the crucible and dried to a constant weight in Freas electric vacuum oven at 80° C. To prevent frothing of the albumin care was taken to start the vacuum gradually and slowly increase it up to 63.5 cm (25 inches). The table below, on five eggs as an example, gives the data in percentages for the content of dry matter in the three layers of albumin:

Egg Number	Percentage of Dry Matter		
	Outer	Middle	Inner
1	12.55	12.87	15.14
2	11.07	11.98	13.61
3	12.13	12.96	14.66
4	11.09	12.24	14.00
5	11.12	12.23	15.07
Average	11.59	12.45	14.55

Such an experiment can be performed only with fresh eggs or eggs well preserved. The albumin of old or incubated eggs loses the distinctive physical appearance of the three layers and does not give the variable results upon the analysis.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE WEST INDIAN VOLCANOES

PELÉE, whose renewed activity is causing anxiety in Martinique, and Soufrière, which is showing signs of sympathetic eruption on the neighboring island of St. Vincent in the West Indies, are only two outlets in a complex of volcanic activity that really embraces the whole curving chain of islands known as the Lesser Antilles. This archipelago is really a semi-submerged mountain chain that is still lifting itself upward from the ocean floor, with great submarine valleys plunging precipitously off their sides. And wherever mountain chains are actively in the making, volcanoes may be expected.

The last known eruption of any volcano in these islands, according to Dr. Henry S. Washington, of the geophysical laboratory of the Carnegie Institution of Washington, was the disastrous explosion of Pelée in 1902, which was accompanied by a less destructive outbreak on the part of Soufrière of St. Vincent. In 1907 there was an ash-fall reported by some 20 villages in the islands, but its source could not be traced. It may have come from a submarine eruption.

Submarine eruptions are probably not uncommon phenomena in the Lesser Antilles, although in the nature of things they can not be as accurately observed as those of known volcanoes. Almost a century ago, in 1837, the French brig *Le César* reported sighting a tremendous fire, that seemed to spread over the whole heavens; it lasted for four hours. The sudden tidal waves that sometimes visit this portion of the ocean are believed to be due at least in part to submarine volcanic eruptions.

After its eruption in 1902, Pelée began to build up a most notable volcanic plug or spine, which rose 500 feet above its crater rim and emphasized the bareness of the summit that has given the volcano its name. "Pelée" in French means "bald." After slowly squeezing upward for several years, this pinnacle of lava fell to pieces. Soufrière, on St. Vincent, is one of three West Indian volcanoes bearing the same name. This arises from the common circumstances that many volcanoes yield sulphur; in French "soufrière" means merely a place where sulphur may be found.

A TRANS-ATLANTIC TELEPHONE CABLE

EARLY in the year 1932, it will probably be possible to talk from the United States to Europe by telephone regardless of the static and atmospheric conditions that interfere with trans-Atlantic radio at times. By then it is expected that a trans-Atlantic telephone cable will be in use, providing an all wire voice circuit between the two continents.

Engineers at the Bell Telephone Laboratories are now working on the development of the cable system, which will connect New York with London. Long distance lines will radiate from each of these cities to the other parts of Europe and America. It is not expected that the cable will replace the present radio system, but its greater reliability will assure a connection at all times. It will also provide an additional channel so that more messages can be handled at once. The telephone cable will only handle one conversation at a time.

Recently developed alloys of nickel, cobalt and iron make telephony by cable possible. This metal is known as "perminvar." It is not used to carry the currents that traverse the cable, but is wrapped spirally around the cable as loading. A copper wire in the center is the actual conductor.

With a plain copper wire, which was used in the first cables, the wire and the sea outside acted as a condenser, even though the wire was fully insulated. Electricity is stored in a condenser something like water in a tank, so it is sluggish in its action. The condenser, which is the entire cable, must be charged before the operator at the other end gets a signal, while it must be discharged before another signal can be sent. This made early cable transmission very slow.

This capacity of the cable—the property that makes it a condenser—can be overcome by loading it. This is done by wrapping it with wire or tape made of metal which becomes magnetized by the slight currents flowing through the cable. For use in telegraphy, the Bell Laboratories developed an alloy called "permalloy," which is now in use on several high speed cables. These cables respond instantly to signals from the transmitting end.

Perminvar has a further advantage over permalloy, however, for it is affected the same extent by the same variation in current, whether in a weak current or a relatively heavy one. With telegraph cables, the current either flows or does not flow, and the change is from on to off so this property is not needed. Telephony, however, requires a wide range of current strength, to take care of the modulations of the voice. With a cable loaded with perminvar, this is possible.

The route of the new cable has not yet been definitely determined. Probably, the submarine part will be from Newfoundland to Ireland, a length of about 2,100 miles. From Newfoundland, the circuit will be carried through several other cable sections to Nova Scotia and thence over land wires to New York. From the Irish end, a submarine cable will carry it across the Irish Channel to Scotland, and then land wires will take it to London.

THE ECONOMIC VALUE OF SKYSCRAPERS

ON a piece of city realty, with the land worth $200 per square foot, a 63-story building will yield the greatest return on the investment. With the land worth $400 a square foot, which is more nearly the value of land in the Grand Central Terminal region, a 75-story building will pay best. The engineering difficulties of a building as high as 2,000 feet, or nearly 200 stories, could be overcome, but such a structure would not be economically feasible. Even a building of 131 stories would not return any net income.

These are some of the principal conclusions drawn from a study that has been in progress during the last two years, under the direction of W. C. Clark, New York economist, for the American Institute of Steel Construction. Many arguments have been advanced on both sides of the skyscraper question, but the institute recognized that the decisive one would ultimately be whether or not the tall building is more profitable than the low one.

For the purposes of the study, the committee considered a specific site in New York near the Grand Central Terminal, on which the Lincoln Building, of 52 stories, is now being erected. Plans were actually drawn for eight separate buildings on this location, ranging from 8 to 75 stories. These were of the setback type, required for high buildings by the New York zoning laws. Estimates of costs and incomes were made for each of these by experienced architects, engineers, builders, building managers and rental agents.

The eight-story building, they found, would cost $22,193,000 to build, and would yield but 4.22 per cent. on the investment, at a land value of $200 per square foot. The 63-story building, costing $39,100,000, would give a return of 10.25 per cent. For higher buildings, the return decreases, becoming 10.06 per cent. for a 75-story building. Estimates made of returns on still higher buildings indicated that at 131 stories the net income would vanish. For higher land values, however, higher buildings are more economical. At $400 per square foot, the committee found, the 75-story building would give the greatest return.

From an engineering standpoint, Mr. Clark stated, buildings could be built up to 2,000 feet. This limit is imposed chiefly by the elevators, as the weight of the cables would become too large for greater altitudes. Also, he said, the normal human ear drum can not stand an elevator speed greater than 1,500 feet per minute. This speed would have to be attained for practical operation in a building of this size.

At present, the Woolworth Building in New York, 792 feet, or 58 stories, is the world's tallest. The Chrysler Building, now under construction, will reach 808 feet with its 63 stories. The Chicago Tower, now contemplated, may ascend to 880 feet, with 75 stories.

THE CULTIVATION OF SUGAR BEETS

SUGAR beets, mangolds and other root crops whose tendency to go to seed too early is as troublesome to the planter as broody hens are to the poultryman who wants eggs have been cured of their habit by the paradoxical method of encouraging them in it. This has been disclosed by a study of the experiments of the late William Bateson, director of the John Innes Horticultural Institution and one of the world's leading students of genetics and evolution.

Sir A. D. Hall, present director, explains that the tendency of beets and similar crops to produce seed during the first year's growth is an expensive waste, for every beet that does it is lost so far as sugar-making or cattle-feeding is concerned. This habit is called "bolting." Sometimes five per cent. or even more of a field of beets will prove bolters.

The cure consisted in exposing prospective seed beets to extreme temptation to bolt, and then selecting the stable individuals that were able to withstand the impulse as the progenitors of the next seed generation. Seeds from the commercial strain to be experimented upon were sown under glass in December or January and the seedlings were planted out about the middle of April, when another lot of the same seed was sown in the open. Most of the planted out seedlings would bolt but the few which did not would be stored and planted out the following season to produce seed.

The results for Golden Tankard mangold are typical. From seed sown under glass in December, 1915, 25 plants were obtained, of which eight were non-bolters. Their seed did not bolt when sown in January, 1918, nor again in the next generation. Even so this seed was still not entirely freed from bolters, for when it was tried out more severely still, *i.e.*, sown December 20, 1920, when a year old, it yielded 7 bolters from 737 plants. After this further selection three generations gave no bolters from January sowings, nor any naturally in the open.

Sugar beet was not so readily freed from bolters. A particular strain at the outset gave 70 per cent. bolters under forcing, 63 in the next generation, and 71 per cent. in the second. In the third generation, however, no bolters were obtained from a total of 326 plants.

RED CLOVER

THE definite strains of short-headed red clover blossoms which are becoming established are the result of the gradual disappearance of bumble bees in sections of the country which have become intensely agricultural and the taking over of their task by the shorter-tongued honey bees, according to Harry F. Dietz in a recent publication on "Pollination and the Honey Bee" issued by the Indiana Department of Conservation.

The long nectar tube of the red clover has heretofore made it practically dependent on the bumble bee for fertilization. Bee-keepers have looked with longing at the amount of potential honey available in the red clover, but it was impossible to breed a type of honey bee which had a tongue long enough to reach the treasure. With the bumble bees going, red clover as a seed crop seemed doomed.

However, as the yield of clover seed lessened each year, a greater per cent. of this smaller amount came from the occasional shorter tubed red clover blooms which short-tongued insects had been able to fertilize. As seed from these short-corolla flowers generally produced plants in their turn having the same kind of blossoms, the tendency was to produce a type of blossom which the honey bee can work. Though slow at first, the change has been hastened and the increasing yield of clover seen in the vicinity of apiaries seems to indicate that the red clover will eventually turn all its mating problems over to the honey bee.

A NEW REMEDY FOR ANEMIA

DRIED stomachs of hogs are soon to vie with livers as the saviors of sufferers from pernicious anemia. This newest anemia remedy, made from one of the few unused

parts of hogs, has just been developed and announced by Drs. Cyrus C. Sturgis and Raphael Isaacs, of the Simpson Memorial Institute for Medical Research of the University of Michigan, and Dr. Elwood A. Sharp, of the Department of Experimental Medicine of Parke, Davis and Co. An ounce of extract from the dried, ground stomachs of hogs is as effective a remedy in pernicious anemia as a pound of raw liver or three ounces of the most concentrated liver extract yet made.

This is the latest step in the conquest of a disease, pernicious anemia, which a few years ago was in the category of the unvanquished ills of mankind. In 1926 it was found that by feeding liver to anemia patients their red blood corpuscles could be increased. Liver, once the poor man's meat, increased in price rapidly. Then the active principle in liver was extracted so that anemia patients could take small doses of the extract instead of eating large quantities of the liver itself. Now comes the new and cheaper source of the anti-anemia principle.

The new extract from hog stomach is not yet commercially available. But it will be far cheaper than liver or the costly liver extracts on which pernicious anemia patients until now have been dependent. Hogs' stomachs are largely a waste product, finding only slight use in the production of pepsin. The dried extract is practically tasteless and looks something like sawdust particles. Beef stomach and ox stomach are sold as tripe, which is a familiar food to many. Hog stomach, which has a different structure, is ground and dried to make the new extract. An immediate increase in the number of red blood cells took place when this dried hog's stomach was fed to patients suffering from pernicious anemia. The increase was even greater than that following liver treatment.

The new remedy for pernicious anemia was partly inspired by the work of a British scientist, Dr. W. B. Castle. In pernicious anemia the red blood cells fail to mature properly. Dr. Castle demonstrated that the stomach of normal persons secretes a substance which could develop a blood-maturing principle from meat. Consideration of this led the University of Michigan scientists, Drs. Cyrus C. Sturgis and Raphael Isaacs, to test the effect of stomach tissue itself. Working on much the same theory, Dr. Elwood A. Sharp, of the Department of Experimental Medicine, Parke, Davis and Co., arrived at a similar decision. The three scientists then developed the new remedy together. Dr. Sharp believes it likely that liver or liver extracts supply an essential substance which is easily formed from ordinary food in the normal stomach but which is imperfectly or scantily formed in the abnormal type of stomach found in the patient suffering from pernicious anemia.

ITEMS

THE fossil skeleton of a giant hog which stood seven feet tall has been mounted in Morrell Hall at the University of Nebraska. The fossil was dug up in Sioux County, Nebraska. Only two of the giants have ever been discovered, the other being smaller than the university's specimen. The pig, scientifically termed *Dinohyus hollandi*, lived during the late Oligocene or the early Miocene Age, which would give him an antiquity of some twelve million years.

THE discovery of ornamented pottery that belonged to prehistoric inhabitants of Britain, and buried near the pottery a small bird bone, has set an archeologist, Miss Dorothy M. Liddell, on the track of what sort of tools were used by Stone Age artisans in impressing designs in clay household ware. The bird joint fits neatly in the pattern of the pottery, she reports in the current issue of *Antiquity*. It has been supposed that irregular pieces of stick must have been the customary stylus used in decorating such pottery. Leg bones and wing bones of such birds as the rook, magpie, pigeon, blackbird and goose provided irregular joint ends capable of making a wide variety of the designs popular in Stone Age art, Miss Liddell's investigation has demonstrated.

IN England, ultra-violet light treatment is frequently used in all kinds of different circumstances, and the Medical Research Council suggest that probably in many cases the treatment is neither necessary nor desirable. Dr. Helen Mackay made careful observations of the effects of ultra-violet light on the health of some delicate children from the east end of London. They were given cod-liver oil to prevent or cure rickets, and it was noticed that the results of the artificial light were wholly negative. The children receiving the light treatment showed no gain in weight or height, nor were they observed to improve in spirits. They actually had more minor ailments such as colds than the untreated children. This was probably due to their being kept indoors for the light treatment while the other children were taking exercise in the fresh air.

DR. TAMAOKI, of the pediatric department of the Kyushu Imperial University, has just completed a two-year study of over 7,000 children and has concluded that most children with long eyelashes are in poor health, it has been reported to the American Medical Association. The lashes of consumptive children grow twice as long as those of healthy children. Sickly children have longer and prettier lashes than those in good health. The lashes of healthy children will grow about an eighth of an inch during the first year of life, while those of children suffering from scrofula grow nearly a quarter of an inch, Dr. Tamaoki has found. No explanation of the cause of this condition has been made, nor has it been accepted as a definite criterion of the state of a child's health.

A LARGE glacier in the Caucasus has been found to be in retreat during recent years, thus agreeing with similar shrinkages observed elsewhere, notably in the Alps and in Alaska. This is the principal glacier of the north slope of Mt. Elborus, which forms the source of the Malka River. The expedition of the Russian State Hydrological Institute determined that this glacier has retreated 570 meters since 1889, and that during the past ten years its rate of shrinkage has been about 20 meters a year.

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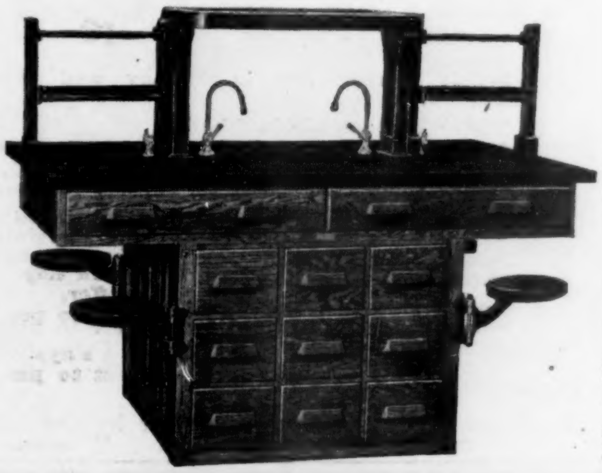

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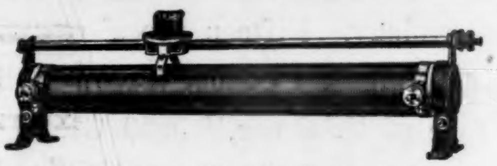

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